

Guidelines for developing human-computer interaction students as reflective practitioners

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Abstract

Human-Computer Interaction (HCI) is a theoretical field that serves as a foundation for design processes. Its primary focus is on addressing the practical needs of users when interfaces and products are created. The researcher, who is also a lecturer for the HCI module, realised that students make little use of the theoretical work they have learned to create solutions for practical work. The research intended to address the theory-practice gap experienced in HCI classes and to investigate practical solutions. The study explored ways to develop the potential of the students to be able to apply appropriate theoretical work to practice. This will subsequently enable them to be ready for the workplace environment. The study further aimed to formulate guidelines to develop HCI students as reflective practitioners to bridge the theory-practice gap.

Different paradigms that are used in Information Systems were explored in terms of their ontological and epistemological stance; and critical social theory was selected. Critical social theory is suitable for this study because the research focuses on emancipating students against the current system through a practical understanding of the present context. This study involved a collaborative investigation where students' knowledge and background served as the foundation for establishing shared assumptions that guided the research. Action research was selected to facilitate this process because of its iterative nature. The process consists of five phases which are diagnosis, action planning, action taking, evaluating, and specifying learning.

The problem is explored by diagnosing it to gain some understanding of the students' experiences before selecting an appropriate theory to guide the action-taking phase. Reflective practice (RP) was identified as a strategy that can be used to bridge the theory-practice gap by assisting students in thinking about what they are doing. The initial set of guidelines was formulated from the students' data. A literature review on reflective practice and human-computer interaction was

conducted, resulting in the development of more guidelines. The guidelines were consolidated to form five categories to be used to develop HCI students as reflective practitioners. Possible interventions were formulated in each iteration to design actual interventions. The aim of the actual intervention was twofold, to improve the RP skills and to verify the practicality of the guidelines. The primary objective of these interventions was to provide guidance to users on how to effectively use the guidelines. After the action was taken, content analysis was employed to evaluate the data collected from the participants. This was followed by a reflection on the results. After three iterations, the five categories of guidelines were sufficiently verified to produce a final set of guidelines to develop human-computer interaction students as reflective practitioners. After this study, the researcher is convinced that when students are skilled in RP, they will be better equipped to apply their theoretical knowledge while creating HCI solutions.

Keywords: action research, content analysis, critical social theory, human-computer interaction, reflective practice

ACRONYMS

A	Area of concern
ACM	Association for Computing Machinery
AI	Actual intervention
AR	Action research
CST	Critical social theory
CUT, FS	Central University of Technology, Free State
DSR	Design science research
ECP	Extended curriculum programme
F	Framework of ideas
FMA	Checkland's model
HCI	Human-computer interaction
HMI	Human-machine interaction
IS	Information systems
IT	Information technology
LMS	Learning management system
M	Methodology
PACT	People, activities, contexts, and technologies
PI	Possible intervention
RP	Reflective practice
SIGCHI	Special Interest Group on Computer-Human Interaction

To God be the Glory.

Psalm 118:23 – This is the Lord’s doing; it is marvelous in our eyes.

DEDICATION

In memory of my grandfather, Gabriel Tlale, my father, Mothibedi Jeremiah “Ou Jerry” Tlale and my younger brother, Lerato Johnson Tlale. As’phelelanga.

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DECLARATION

I, *Moretlo Tlale-Mkhize*, declare that:

Guidelines for developing human-computer interaction students as reflective practitioners

is my personal work and that each source I quoted or used is acknowledged and indicated through complete referencing.

Signature: 

Date: 04 December 2023

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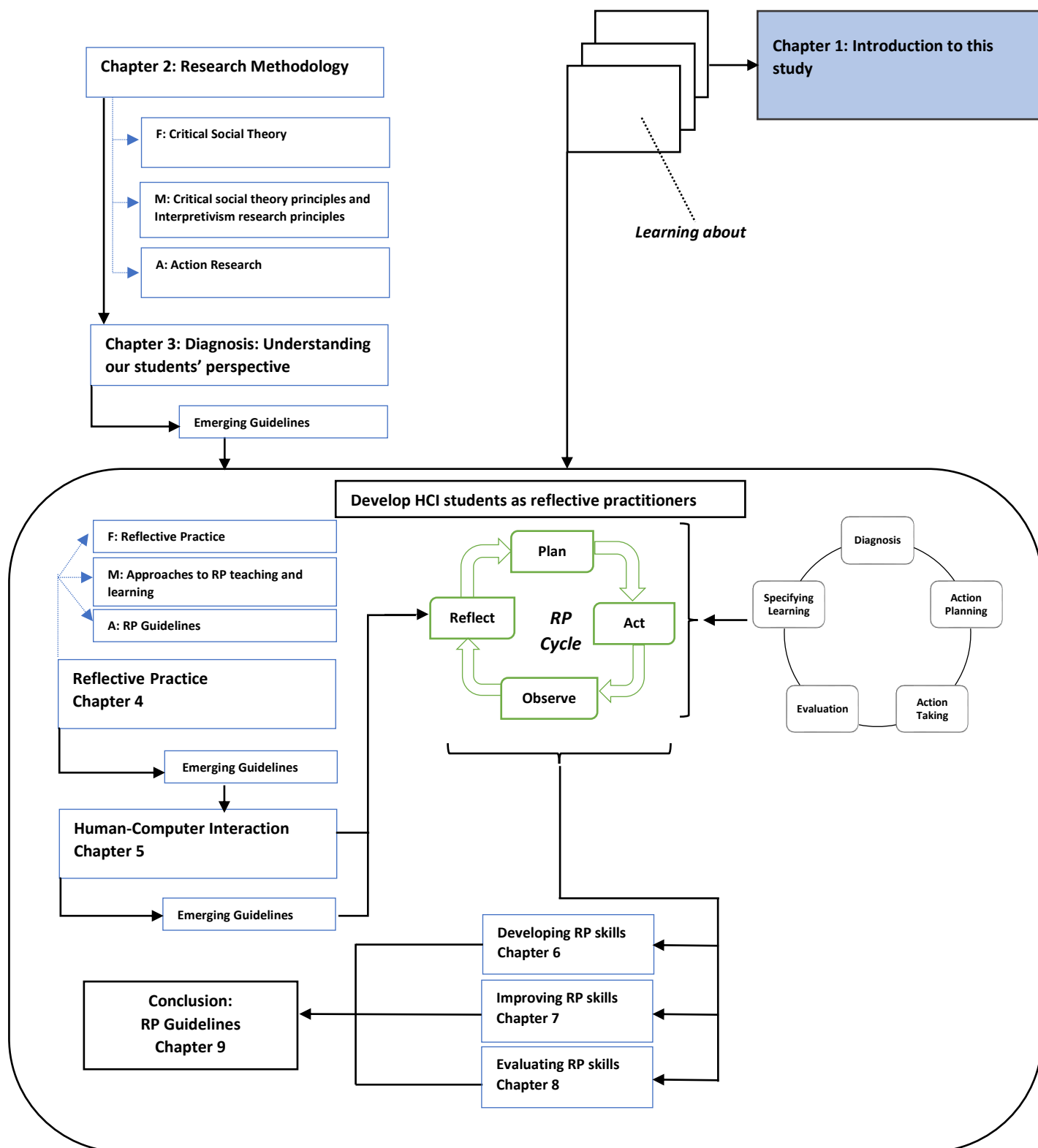
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CHAPTER 1: INTRODUCTION TO THE STUDY

1.1 Introduction

There is a perceived gap between the theory being taught in formal education and industry practice (Akram, 2018; Gassas, 2021; Greenway *et al.*, 2019; Monaghan, 2015; Nandakumar & Jain, 2015; Nijhawan, 2017; Syntetos *et al.*, 2016; Warrender, 2021). This discrepancy has also been observed in the field of human-computer interaction (HCI) (Austin, 2017; Gray *et al.*, 2014; Remy, 2017). The difficulty in studying HCI arises from its multidisciplinary nature and the rapid pace of technological advancement (Vasilchenko *et al.*, 2018).

The purpose of HCI is to serve as a theoretical foundation for design processes, while also addressing the practical needs of users in creating interfaces and products (Roudaut *et al.*, 2018). Therefore, HCI requires the knowledge of computers and humans (Alkathairi, 2022; O'Regan, 2021). A key component of HCI is its scientific nature, which involves the application of theories to understand how individuals interact with tools such as computers to perform tasks, as well as a practical aspect that focuses on creating usable interfaces (Kovalchick & Dawson, 2004). The significance of studying the principles of HCI lies in the ability to create interfaces that are both user-friendly and easy to navigate (Alkathairi, 2022).

Students are often taught HCI theory first and afterwards, attend practical classes. The most frequently used HCI teaching method entails assigning students a case study that allows them to apply the theoretical concepts they have learned in class (Collazos & Merchan, 2015).

Enhancing the reflection of students on their learning is a key learning objective in higher education (Bharuthram, 2018; Krapivnyk *et al.*, 2021; Sööt & Viskus, 2015). Incorporating reflection training into course content is crucial for higher education students to engage in reflection and continuous learning throughout their studies in higher education (Quinton & Smallbone, 2010). Through reflection, students can critique their own understanding by formulating new knowledge from what they have learned (Larrivee, 2013). According to Chng (2018), students may be unsure of what to do during the reflection process regardless of how clear the reflective challenge

and objective are. A possible challenge may be the lack of guidelines on how to incorporate reflective practice (RP) into studies. According to Thomas and Volschenk (2021), clear guidelines on how to incorporate RP into the learning programme could help improve the use of RP. The objective of this study is to formulate guidelines to develop HCI students as reflective practitioners to bridge this gap.

According to Schön and DeSanctis (1986), both ordinary people and professional practitioners often continue to think about what they are doing from time to time, while they are actually doing it and ultimately turn what they are thinking about into an action. They refer to this as reflection-in-action. The book entitled “The Reflective Practitioner” authored by Schön (1983a), has had a significant impact on how people think about reflection, particularly with regards to professional practice (O’Connell & Dymont, 2013).

The concepts that are central to this study are discussed in Section 1.2. This is followed by the research methodology concepts in Section 1.3. Section 1.4 states the problem statement and motivation for the study. The structure of the study is discussed in Section 1.5, followed by the objectives of the study in Section 1.6. Section 1.7 discusses the research design and methodology. Section 1.8 presents rigour and evaluation of the chosen method. Section 1.9 details the ethical considerations relevant to this study. Lastly, Section 1.10 provides an outline of the chapters of this dissertation.

1.2 Concepts central to the study

In order to provide the context of the study, the following aspects were identified as key concepts in the study: HCI as a discipline, teaching HCI, and reflective practice. A brief overview of each concept is presented below.

1.2.1 Reflective Practice

Reflection is an active process of investigating, and discovering by bringing to light new understanding which was not anticipated (Boud et al., 2013). It is also defined by Loughran (2002)) as a process that informs the development and understanding of what is being learned. According to Patil (2013a), it is uncovering new insights, significance, and a deeper understanding, while expanding upon our existing

knowledge. By engaging in reflection, we can identify and rectify any inaccuracies or faults in our theoretical understanding and problem-solving approach (Mezirow, 1987). It also assists in constructing a new theory (Larrivee, 2013). Reflection enables us to develop new understanding that assists in enhancing the actions to be applied to practical situations (Ghaye, 2010). The objective of reflective practice (RP) is not to replace theory, but rather to enhance one's knowledge of practice by drawing on theory (Bassot, 2023).

1.2.2 Human Computer Interaction as a discipline

Human–computer interaction is about studying how users interact with a computer system regardless of the environment in which the system is utilised (Helander, 2014). The aim of HCI is to understand what designs the users need and what tasks they will undertake to meet their needs by designing usable systems (Smith-Atakan, 2006). The field of HCI ensures that designers focus on users (Benyon, 2014). It also brings theory and practice together (Smith-Atakan, 2006) by applying theoretical content learned to practice (Greenberg, 1996). It also provides an opportunity to evaluate the system in terms of effectiveness and efficiency of the design (Smith-Atakan, 2006). The goals of HCI are safety, utility, effectiveness, efficiency, usability and appeal (McCracken *et al.*, 2004:4).

1.2.3 Teaching Human Computer Interaction

Teaching HCI using traditional methods can be a challenge. Kotzé and Oestreicher (2002) argued that the traditional methods used to teach HCI and usability do not work as effectively as they are generally believed. Comparable findings are reported by Barnes and Tynan (2007) that the traditional lecture is not interesting, and that students find it boring. HCI is a multidisciplinary course, and its diversity is drawn from different subjects, making it difficult to teach (Khan, 2016). HCI teachers often concentrate on the theory and basics of HCI and avoid teaching practical lessons (Oleson *et al.*, 2018). Practical classes aimed at project work are sometimes used as an opportunity for students to apply the knowledge gained from theory (Dawood, 2016).

1.3 Research methodology concepts

The aim of this section is to discuss the methodology concepts that are used in information systems and their suitability for this study. The research paradigms and action research methodology are discussed.

1.3.1 Research Paradigms

A paradigm is defined as a particular way of thinking about problems grounded on a set of accomplishments that are accepted as a basis of further research practice (Recker & Niehaves, 2008). Moreover, a paradigm refers to a set of theories which are characteristic of a historic period in the philosophy of science (Kroeze, 2011b).

Every paradigm is grounded in its ontological and epistemological assumptions (Scotland, 2012). The nature of reality is referred to as ontology, whether external or internal to the knower from a philosophical viewpoint (Taylor, 2013), whereas epistemology involves the nature and origin of knowledge by asking how we know what we know (Tronvoll et al., 2011). Positivistic, interpretive, critical social theory (Myers & Klein, 2011), and design science (Gregor & Hevner, 2013a) are the four paradigms often used in information systems (IS), and are evaluated in terms of their suitability for this study.

The positivistic paradigm is also known as the scientific method of conducting research and is associated with quantitative studies (Wijesinghe, 2011), and the results can be measured by observation (Gray, 2013). Research methods preferred by positivist researchers are based on the assumption that the measurements of empirical phenomena can be exact and specific (Howcroft & Trauth, 2005). The positivist paradigm claims that knowledge is absolute and objective, and that there is only one objective reality that exists outside of human beings (De Villiers, 2005; Gray, 2013). Positivism assumes a certain view of the world which is referred to as ontology and is based on the idea that the world exists as an external reality (Kroeze, 2011b). Positivists maintain the position that logical deductive reasoning, scientific enquiry, and replicable findings converge upon understandable objective truths (Plack, 2005). Epistemologically, researchers commend the use of a scientific approach by developing numerical measurements to produce acceptable knowledge

(Wahyuni, 2012). According to Howcroft and Trauth (2005), positivist IS research pursues the discovery and testing of law-like theories and causative relations among concepts that objectively describe an existing reality. The positivist research paradigm tests theories and hypotheses, whereas this study aims to develop new knowledge about developing human-computer interaction students as reflective practitioners. Therefore, the positivist research paradigm was not suitable for this study.

Interpretive research was initially developed in the social sciences and is now employed in educational research (De Villiers, 2005). The interpretivist paradigm was established as a criticism of positivism (Mack, 2010). Interpretivists believe that social actors and individual viewpoints formulate reality (Wahyuni, 2012). Interpretive methods of research adopt the position that our knowledge of reality is socially constructed by individuals (Walsham, 1995). The emphasis of interpretivist research is placed on the construction of theories and systems (Xinping, 2014). Interpretivist ontology takes the stand of relativism (Scotland, 2012). Ontologically, interpretivists believe that the world can be observed from multiple perspectives (Clarke, 2009). Interpretive epistemology is a type of subjectivism grounded in real-world phenomena (Scotland, 2012). The objective of this study is to develop HCI students as reflective practitioners. The aim is not only to describe the actions of the students but also to facilitate change. In this study, the researcher aims to develop new knowledge by orchestrating change, which is different from the descriptive nature of interpretive studies. Therefore, the interpretivist research paradigm is unsuitable as the guiding paradigm for this study. Interpretive methods are used in the study as discussed in chapter 3.

The aim of the design science research (DSR) paradigm is to create new and innovative artefacts by extending the boundaries of human and organizational abilities (Hevner *et al.*, 2004). Peffers *et al.* (2007) stated that DSR is important in a discipline focused on creating successful artefacts. Artefact development should be based on a search process to find a solution to a defined problem that draws from existing theories and knowledge (Peffers *et al.*, 2007). An application domain consists of people, organizational systems, and technical systems that interact to work together to achieve a goal (Hevner, 2007). The outcome of the application

domain of design science research must be returned to the environment for study and evaluation (Hevner, 2007). Design science is concerned with the problem of determining and categorising all regular phenomena of the systems to be designed and the design process. Ontologically, design science is realistic, materialistic, and epistemological, and knowledge is created by reflecting on the design and development of the artefact (Baskerville et al., 2009). The purpose of design science is to create and evaluate IT artefacts intended to solve identified organizational problems in IS (Hevner *et al.*, 2004). In this study the aim is not solely to formulate guidelines for HCI to develop HCI students as reflective practitioners, but also to facilitate a positive change. Therefore, design science research is not suitable as the main research paradigm for this study.

Critical social theory is a school of thought which has its goal based on advancing the condition of humans (Ngwenyama, 1991). Critical theorists believe that it is not adequate to merely describe and understand human behaviour; rather, they challenge oppression and question the status quo by seeking to improve the well-being of humans in society (Plack, 2005). Moreover, critical social theory (CST) emphasises the emancipation of humanity through improving social conditions (Thapa & Harnesk, 2014), which brings about changes that are required. With this in mind, emancipationist research enquires about what is fair and what can be done to transform the society. Ontologically, critical theorists maintain that knowledge or reality is a historical reality (Plack, 2005). Critical epistemology stands as a type of subjectivism grounded in real-world phenomena and associated with societal ideology (Scotland, 2012). Critical information systems researchers still need to demonstrate how and to what extent the knowledge produced informs and is informed by information systems (IS) practice (Howcroft & Trauth, 2005). This study aims to develop human–computer interaction students as reflective practitioners. This means that the emancipatory element must be explored to achieve the objective of the study; therefore, the CST paradigm is suitable for this study.

1.3.2 Critical Social Theory Research Methodology

The selected research philosophy is a critical research paradigm and the research method that was adopted is action research. According to Ngwenyama (1991), the

aim of critical social theory is to promote social conditions that address human desires more effectively in order to improve the quality of life. Myers and Klein (2011) emphasised that critical research is evolving as a possibly significant stream in information systems research and that it looks at societal issues such as freedom, power, social control, and values with respect to the development, usage, and influence of information technology. One of the features that describe critical social theory is its emphasis on self-reflection, including how knowledge develops out of and is positioned in a specific setting (Devetak, 2005). One of the assumptions stated by Ngwenyama (1991) about CST is that it must be reflective in terms of collaboration between researchers and people who was affected by it.

Myers and Klein (2011) claimed that there are three interrelated elements for conducting critical research. These three elements are insight, critique, and transformation. They describe the elements as follows: the first element, insight, is to gain a wide range of knowledge regarding the present context prior to engaging in critical research. This includes, but is not limited to, a careful description of the current context. Second, critique is concerned with the lineage of knowledge and social practices of control and reproduction. The reason for critique is to disclose the normative basis of the current context and the forms of legitimisation that rationalise the present social order. Third, for transformative redefinition, the aim is to suggest advancements to the circumstances of human existence, existing social preparations, and social theories.

In terms of action research, previous studies have indicated that the use of AR methods is appropriate for the discipline of Information Systems (Baskerville & Wood-Harper, 1996; Baskerville & Wood-Harper, 2016; Baskerville *et al.*, 2009). Baskerville (1999) argues that Information System (IS) research can be referred to as a social enquiry rather than social science; therefore, the application of AR in IS helps researchers to understand a given social problem and assists in establishing practical problem-solving techniques (Lau, 1997). Action Research provides solutions that improve the standards of a given problem (Mertler, 2016b), and is designed to resolve an immediate problem situation (Baskerville, 1999). Furthermore, it is suitable for solving problems in specific contexts (Mertler, 2016b). In this study, developing human–computer interaction students as reflective

practitioners using an AR approach could be suitable because this phenomenon involves social enquiry and is unstructured. One of the key aspects of social emancipation is challenging oversimplified explanations, which enables individuals to think deeply about their actions and recognise the impact of ideology and social discourse on their understanding of those actions (Hadfield, 2012). The concepts presented here provide a foundation for the in-depth analysis provided in Section 2.2.4.

1.3.3 Action Research as research methodology

Action research (AR) started with the idea of the researcher as an “active participant” when solving practical problems in the course of studying them in a setting where research is conducted (Peppers et al., 2007). AR is a collaborative approach between researchers and practitioners (Gray, 2013; Wing & Andrew, 2017). Furthermore, the emphasis of AR is on taking an involved role as a participant in planning and implementing change, which also influences the process rather than only observing (Oprešnik & Dolinšek, 2012). Therefore, action research is conducted by individuals who play an active role as practitioners and have a vested interest in the educational setting (Mertler, 2016a). AR strives to comprehend issues and justify them through practical application (Erro-Garcés & Alfaro-Tanco, 2020).

The process of AR is iterative and reflective in nature (Baskerville, 1999), consisting of the following five steps: diagnosis, action planning, action taking, evaluating, and specifying learning. Action research is relevant for studies that involve human-computer interaction because it is iterative in nature (Preece et al., 2015) by linking theory and practice (Baskerville, 1999).

The phases of the AR research process are as follows (Susman & Evered, 1978):

- Diagnosing phase is where the problem is identified and defined.
- Action planning phase is where alternative solutions and actions are considered, based on theory.
- In the action taking phase, a course of action or intervention is selected and implemented. This is where prototypes, technologies, and technology demonstrators have been developed.

- In the evaluating phase, the consequences and impacts of the action or intervention are studied or observed.
- In the specifying learning phase, the research findings and evaluation results are documented and published. Learning is fed into a new cycle that starts a new diagnostic phase.

1.4 Problem Statement and Motivation of the Study

Human-Computer Interaction is a practical subject that should be taught through both theory and practice. Practicing HCI involves a hands-on approach, emphasizing the demonstration of creativity in practical tasks rather than theoretical work. In teaching HCI, there are circumstances that make us focus on theoretical work. The assessments are based on theoretical work rather than practical work. Students tend to study theory to pass the module and neglect practical work. They focus on obtaining qualifications without sufficient preparation for the workplace.

The reflective practice concept involves the incorporation of theory and practice (Dybå, Maiden & Glass, 2014; Dybå, Maiden & Robert, 2014). Through reflection, HCI students can draw from the knowledge they have gained in theory and apply it in practice by formulating an understanding of where they did well in their learning and identify areas that need improvement in the future. Therefore, HCI students require reflection in order to bridge the gap between theory and practice. Lecturers can assist them to become reflective practitioners by providing them with tools that they can use for their entire lives. Despite the broad literature that addresses RP, there are no guidelines to develop HCI students as reflective practitioners. This study aims to address this gap and enhance our understanding on the application of RP in an HCI context.

1.5 Structure of the study

The study applies action research, and the framework of ideas (F) is used in a particular methodology (M) which is applied to investigate an area of concern (A), as shown in Figure 1-3, referred to as the FMA illustration (Checkland & Holwell, 1998). Furthermore, it is essential to declare the elements of the FMA in advance, which will lead to the recognition of the findings and research lessons (Checkland & Holwell,

1998). The ideal domain of a research method is one in which M provides the richest scientific knowledge about F in the context of A (Baskerville & Wood-Harper, 1996).

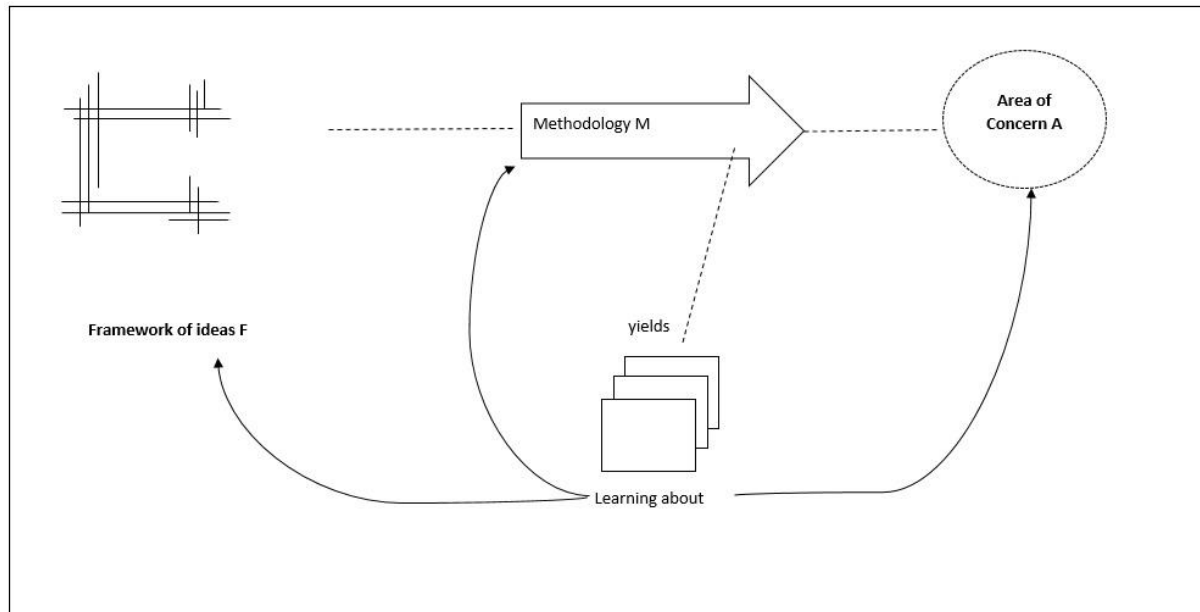


Figure 1.1: FMA illustration - Elements of research (Checkland & Holwell, 1998:13)

Based on the FMA illustration in Figure 1.1 above, the proposed structure of this study is shown in Figure 1.2.

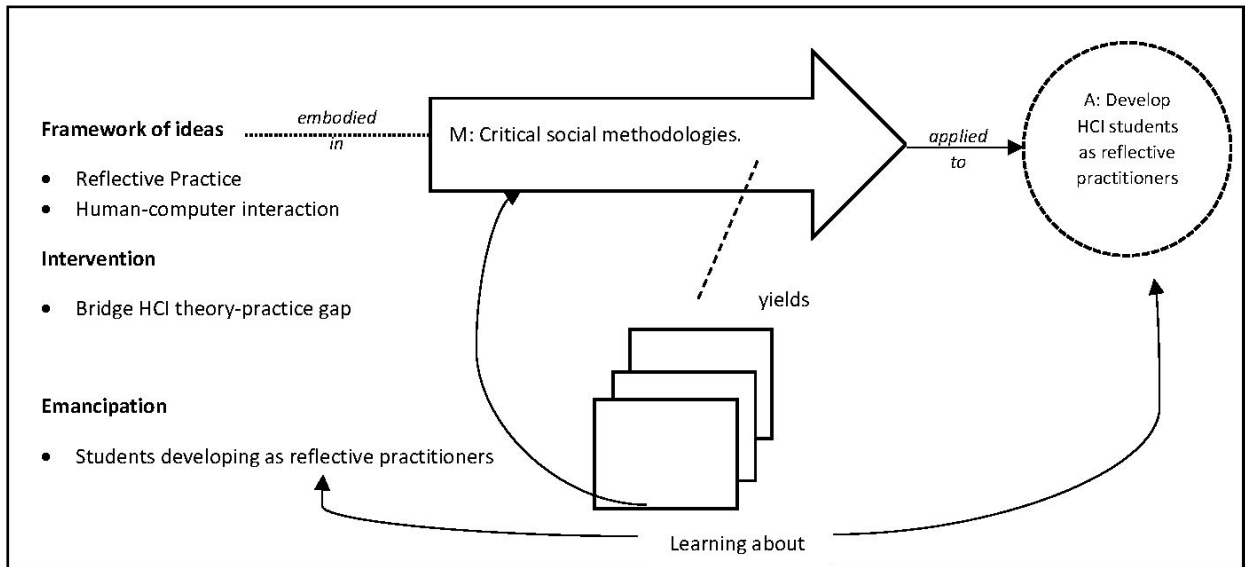


Figure 1.2: Proposed structure of the study

FMA is applied in the process of action research (AR), as shown in Figure 1.3. It deals with entering a problem situation, which refers to the area of concern, declaring epistemology in terms of recognising what counts as learning, taking part in the change process, reflecting upon the experience, and recording the learning.

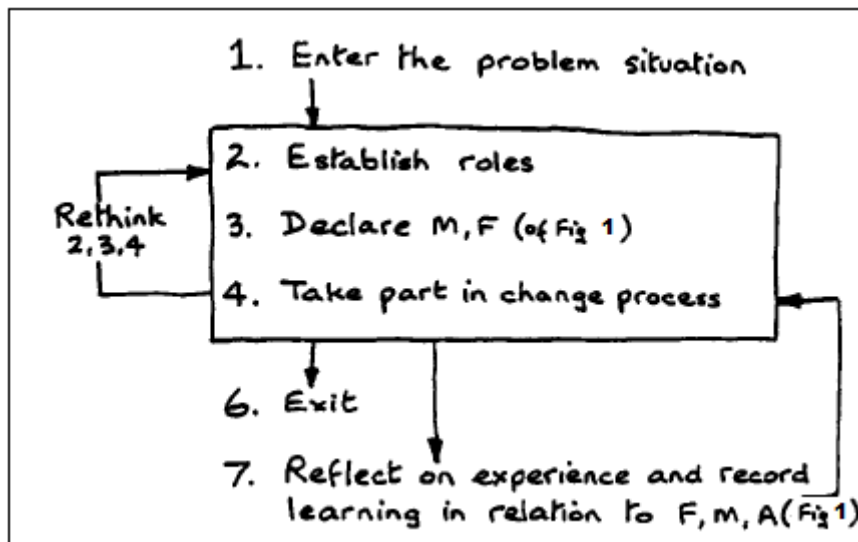


Figure 1.3: The process of action research (Checkland & Holwell, 1998)

1.6 Objectives of the Study

This study aims to formulate guidelines to develop human-computer interaction students as reflective practitioners. An overview of the primary and sub-objectives of this study follows.

1.6.1 Primary Objective

The primary objective of the study is to formulate guidelines to develop human-computer interaction students as reflective practitioners.

1.6.2 Secondary Objectives

The secondary objectives in terms of the theoretical objectives and empirical objectives for this study are discussed in this section.

1.6.2.1 Theoretical objectives

The aim in setting the theoretical objectives for this research is to report on insights regarding the key concepts of this study, including the following:

- To present a justification for the selection of a suitable research approach and to provide a shared understanding of selected research methods in support of the research plan;

- To present a literature review leading to guidelines for developing HCI skills of students; and
- To consolidate the guidelines for the development of RP and HCI by formulating guidelines that will assist in the development of HCI students as reflective practitioners.

1.6.2.2 Empirical objective

The empirical part of this study was based on a critical research paradigm through action research. The objectives are:

- To present the detail of an initial investigation to improve understanding of the experiences of the participants of the study to guide subsequent AR iterations;
- To conduct an AR investigation after the literature review using the developed guidelines, for each AR iteration:
 - *Diagnosing*: To present a reflection on the findings of the previous cycle in terms of student development and guideline development and verification;
 - *Action planning*: To present possible interventions which would develop the RP skills of the HCI students guided by guidelines and to verify the practicality of any unverified guidelines;
 - *Action taking*: To present detail of the actual interventions in the specific research environment based on the possible interventions subject to the constraints in the environment;
 - *Evaluating* – To present the data collection and analysis of an interpretive investigation aiming to investigate the success of the intervention both in terms of student development and guideline verification;

- *Specifying learning*: To present the findings of the evaluation phase in terms of student development, guideline verification, and development of additional guidelines.
- To present a final set of guidelines to develop HCI students as reflective practitioners.

1.7 Research design and methodology

1.7.1 Literature review

In order to realise the objectives of the study, the secondary data sources that was be used will include relevant textbooks, journal articles, the Internet, and conference papers from local and international sources.

1.7.2 Study participants

This study involved students registered with a University of Technology (UoT). The target group consisted of students enrolled in an IT program. The study participants were recruited from a particular UoT where the researcher had access to the participants and could be part of the research.

1.7.3 Data Collection and Analysis

Various methods can be used to collect research data, and researchers can use more than one technique to obtain a range of perspectives (Biggam, 2015). Two sources of data collection and analysis were used in this study. Data were gathered using reflective sheets during the diagnosis of the problem, first and second AR cycles. Reflective sheets, which are within the scope of data from documents, allow students to make self-assessments and reflect on their work. The second source was interpretive interviews to collect the qualitative data. Interviews permit data to be collected by affording the researcher the opportunity to gain in-depth insight into the research from the perspective of the participants (Saunders, 2011). The aim of the interviews was, first, to establish if the students were developing as reflective practitioners; second, at a later stage when they submitted their final project, to

determine if they still understood what reflective practice was and whether they applied it in their projects, and if they would apply it in other areas of their career.

Data was analysed using content analysis. Content analysis can be utilised for a wide range of composed text messages, regardless of the origin of the material (Bengtsson, 2016). Furthermore, content analysis is used to test theoretical issues to enhance the understanding of data (Elo & Kynga's, 2008). According to Bengtsson (2016), in qualitative content analysis, data are presented as words and themes, which makes it possible to interpret the results. Therefore, content analysis is suitable for the type of data collected for this study in the form of reflective pages and interpretive interviews.

1.7.4 Contribution of the Study

This study makes two contributions:

Practical contribution: To formulate guidelines for developing HCI students as reflective practitioners.

Theoretical contribution: The first theoretical contribution is reversing the emphasis on theory by illuminating the methods of doing that lead to practice. The second contribution is the application of RP to a variety of practices (to other modules in this context) by enabling participants to stimulate questions that they might not have asked themselves so that they could translate the ideas to their final project of the HCI modules. The third theoretical contribution is the formulation of guidelines that may assist instructors of HCI to incorporate RP to develop students as reflective practitioners. The students were able to apply the theory learned in the practical part of the HCI module to support educational objectives.

1.8 Rigour and evaluation of the method

To ensure that the research method was rigorously applied to this study, the five principles for validation proposed by Heikkinen et al. (2016) were adopted and supplemented by the principle of equitability proposed by Cannon (2018).

- *The principle of historical continuity*: recognition of the evolution of history, that is, how practice and research have been promoted by the quality of human life, and the discovery of a logical sequence of events in the form of a narrative.
- *The principle of reflexivity*: reflective thinking which is crucial in practitioner research and requires practical knowledge. The principle includes an analysis of ontological and epistemological presumptions; that is, presumptions concerning reality and how human practices are constructed.
- *The principle of dialectics*: how the practitioner interprets different voices relating to the same event and provides a space for the authentic voices of the participants to keep them as genuine and original as possible.
- *The principle of workability*: this involves ethical attitude and critical view of change; that is, priority is placed on ethical perfection and faultlessness, which also looks at the outcome and process of validity.
- *The principle of evocativeness*: how well the research provokes new imaginations in a different approach, which is relevant to judging how knowledge is constructed.
- Finally, adopted from Cannon (2018:98), *the principle of equitability*: how well the research adheres to democratic principles of fairness and the sensitivity that is applied to the input and fidelity to the material of the participants.

1.9 Ethical Considerations

To ensure that ethics are considered for this study, the following ethical considerations have been taken into account.

- Permission was requested from the ethics committee of the University of Technology to conduct the study and from the university where the researcher is registered;
- Participants were asked to sign consent forms to ensure that their participation is informed and voluntary;
- Anonymity was ensured with regard to the information gathered from the respondents; and
- The participating UoT was allowed to evaluate results.

Ethical clearance is included in Annexure A. Consent forms are attached in Annexure C.

1.10 Chapter Layout

The study is organised into chapters and reported as follows:

Chapter 1: Introduction to the study

This chapter provides an overview of the research problem and the objectives of the study. It also motivates the importance of conducting this study.

Chapter 2: Research Methodology

This chapter focuses on different research paradigms which have influenced social research over the years. Mainly, the chapter focuses on critical social theory because it enables students who are doing HCI to merge theory with practice, which yielded positive results. Furthermore, critical social theory is reflective in nature, as it enhances students' ability to be emancipated in their learning and to take responsibility for their learning. An overview of the literature on the main research paradigms and historical background of information systems in action research is provided.

Chapter 3: Diagnosis: Understanding our students' perspectives

This chapter presents a holistic view of the problem, which is an area of concern. It also provides background information about the UoT where the research is conducted. The assignment that the students completed is highlighted. Data were collected from the participants, and the results are presented. The first set of the guidelines is derived from the data.

Chapter 4: Reflective practice

This chapter presents an overview of current research and discussions on the application of RP as a framework of ideas. The guidelines towards developing HCI students as reflective practitioners are derived from RP literature.

Chapter 5: Human Computer-Interaction

This chapter presents an overview of current research and discussions on the application of HCI as a framework of ideas. The guidelines towards developing HCI students as reflective practitioners are derived from HCI literature.

Chapter 6: Cycle 1: Developing reflective practice skills

This chapter presents the first cycle of action taken for the study. The guidelines from Chapters 3, 4 and 5 are consolidated and 5 categories are created to guide the instructors on how to develop HCI students as reflective practitioners. The guidelines are tested for their suitability and are either verified or unverified at the end of the chapter.

Chapter 7: Cycle 2: Improving reflective practice skills

This chapter presents the second cycle of action taken for the study. The unverified guidelines are used as the inputs in this cycle to further test their suitability to achieve the objective of the study.

Chapter 8: Cycle 3: Examining reflective practice skills

This chapter presents the third cycle of action taken for the study. The participants are interviewed to determine whether emancipation has taken place as a result of the interventions.

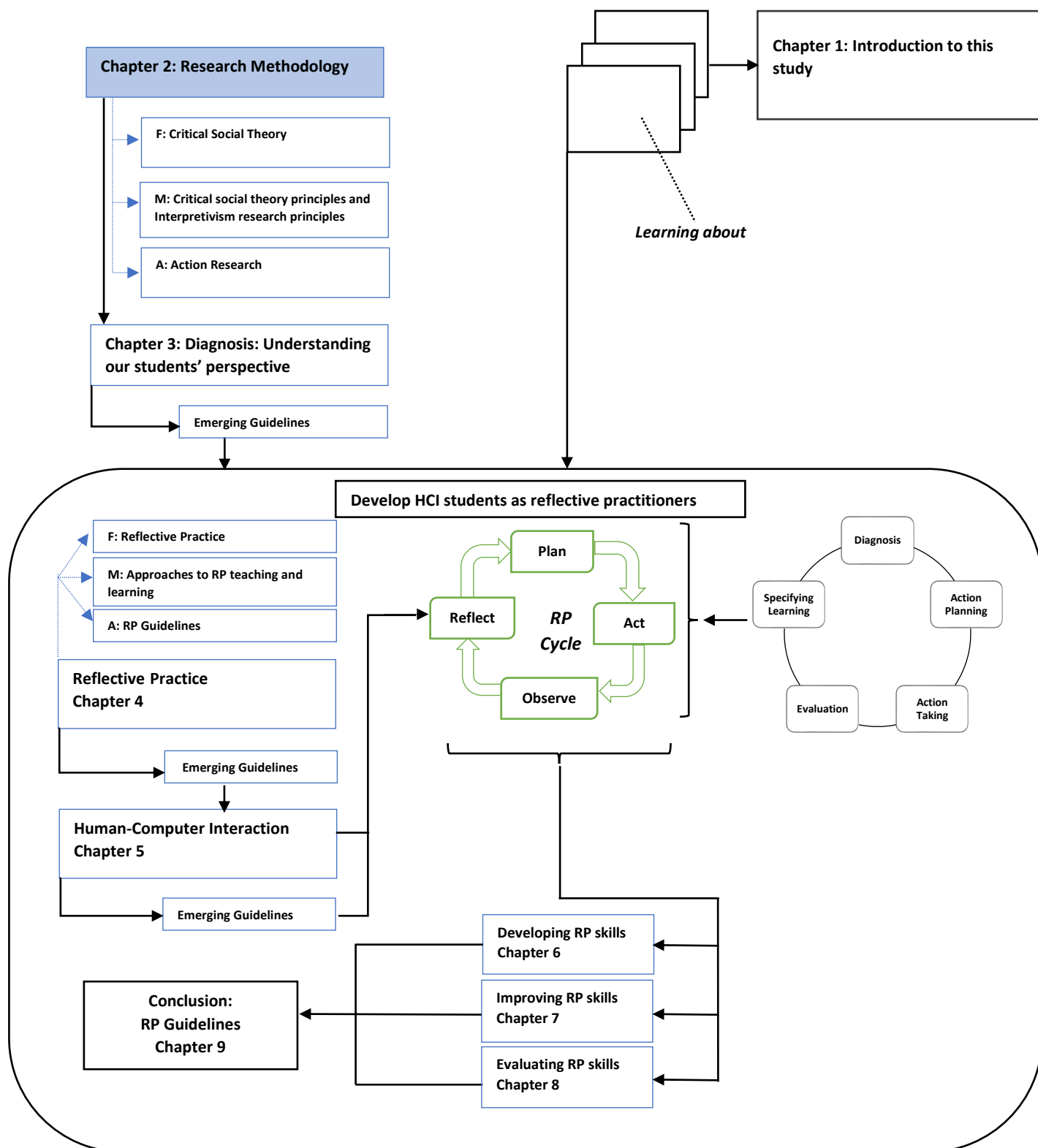
Chapter 9: Conclusion: Reflective practice guidelines

This chapter presents an overview of the findings of the study. The research problem is evaluated to determine if it has been solved. Guidelines to develop HCI students as reflective practitioners are presented. Recommendations for future research are also stated.

1.11 Chapter summary

This chapter served as an introduction to the research. It provided an overview of the problem being investigated and motivation of the study. The practice of HCI is based on a practical part, where creativity should be visible and not theoretical work. Through reflection, HCI students can draw from the knowledge they gained in theory and apply it in practice by formulating an understanding of where they did well in their learning and identify areas that need improvement in the future. This study

formulates the guidelines to develop the HCI students as reflective practitioners. The students are given an opportunity to reflect on what they have learned.



CHAPTER 2: RESEARCH METHODOLOGY

2.1 Introduction

The primary objective of this study is to formulate guidelines for developing human-computer interaction (HCI) students as reflective practitioners. This chapter presents the chosen research methodology to justify the approach used in the study.

The study is based on the Checkland and Holwell (1998) model as illustrated in Figure 2.1. Learning takes place by reflecting on what needs to be adjusted to specify learning in all three aspects (F, M, A).

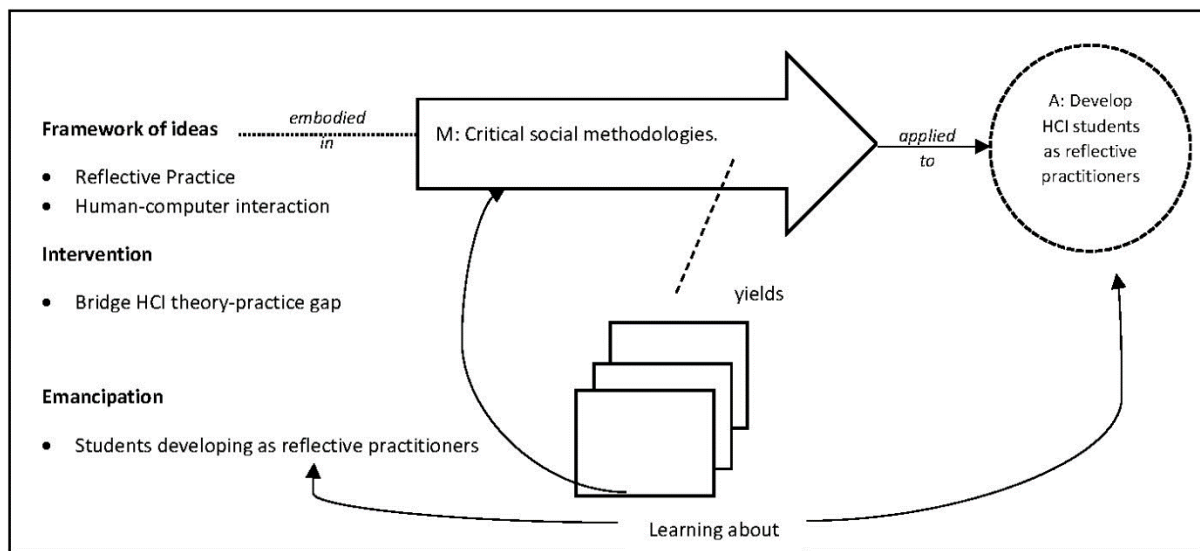


Figure 2.1: FMA illustration: elements of research for this study adapted from Checkland and Holwell (1998)

Section 2.2 presents an overview of the research paradigms (F in Figure 2.1) in the information systems discipline and the development of these paradigms is discussed in terms of their ontological and epistemological assumptions. The research being performed in the critical social research paradigm using action research is addressed in Section 2.2.4. Section 2.2.5 presents the justification of the chosen research paradigm for the study after comparing the ontological and epistemological assumptions.

The research principles (M in Figure 2.1) adopted in the study that guided the research process are addressed in Section 2.3. The principles for critical social research (M) are discussed in Section 2.3.1. Following the presentation of the research principles, the research methods are presented in Section 2.4. The research methods (A in Figure 2.1) are provided to indicate how this research study is conducted and the justification for the use of these methods (A). This chapter also explains the data collection method in Section 2.4.5 and the selected analysis techniques used in Section 2.4.6. The research plan is presented in Section 2.5. Strategies to ensure the credibility of the findings of the study are presented Section 2.6. Ethical considerations of the study are provided in Section 2.7. The chapter concludes with the ethical considerations followed in the process of conducting this study in Section 2.7.

2.2 Research Paradigms (F in FMA)

A research paradigm is specified as a set of shared beliefs and assumptions within a research society about ontological, epistemological, and methodological concerns (Asghar, 2018; Johannesson & Perjons, 2014). In other words, it is a particular way of contemplating problems grounded on a set of accomplishments that are regarded as a basis of further research practice (Recker & Niehaves, 2008). According to Kroeze (2011a), a paradigm is a set of theories that form part of a historical period in science philosophy. Research philosophy is about developing new knowledge in the sense that it may be answering a specific problem and not necessarily developing a new theory (Saunders, 2016). In other words, a paradigm is used to guide the researcher about the methods that were used in the study to answer a research question for a specific concern or issue.

Taylor and Medina (2013) present their overview of major educational research paradigms' characteristics that shape contemporary educational research. In an educational context, paradigms convey theories that are related to teaching and learning, curriculum and assessment, professional development, etc. (Taylor & Medina, 2013). The paradigms provide independently diverse approaches for conducting research, and they give guidance to the practices and methods (Tribe,

2001). Therefore, a paradigm can be viewed as a lens that the researcher uses to perceive the world.

Ontology and epistemology are considered as two main sections of philosophy (Kroeze, 2011a). Each paradigm is grounded on its own ontological and epistemological assumptions (Scotland, 2012). Ontology refers to a view of the nature of reality, which can be independent or subjective to the researcher from a philosophical point of view (Taylor & Medina, 2013). This view of reality is the basis for all other assumptions that influence the researcher's epistemological view (Rehman & Alharthi, 2016; Tronvoll et al., 2011). Conversely, epistemology involves the relationship between the knower and what is known by asking how we know what we know (Krauss, 2005). As a result, Kroeze (2011a) refers to epistemology and ontology as "two sides of the same coin".

Ontological assumptions are concerned with natural existence and what is known about reality, which refers to the study of being (Gray, 2013; Ponterotto, 2005; Scotland, 2012). In other words, researchers want to understand the nature of reality. Likewise, it is the view of how one perceives reality (Wahyuni, 2012). Additionally, Kroeze (2011a) explains that societies perceived reality differently during a specific period in history. According to Kroeze (2011a), the recognized ontology in IS is a taxonomy, which is a subset of reality that outlines the connections between objects.

The term epistemology is derived from the Greek word *epistēmê*, which refers to knowledge (Kivunja & Kuyini, 2017; Krauss, 2005). It provides a philosophical background to determine whether the type of knowledge is credible and sufficient (Gray, 2013). Similarly, epistemology can also be referred to as the type of knowledge that can be produced and determining the standards for qualifying it (Scotland, 2012; Taylor & Medina, 2013; Wahyuni, 2012). According to Kivunja and Kuyini (2017), epistemology is important because it helps to communicate knowledge to be investigated. For the purpose of acquiring knowledge, it should first be understood so that any questions that are not clear can be answered. This ultimately increased one's perspective regarding what one is researching.

Furthermore, it can also be regarded as a theory that makes the essential assumptions concerning understanding and knowledge (Kroeze, 2011a).

The four research paradigms that were discussed in this study are positivism, interpretivism, design research, and critical social theory (CST).

2.2.1 The positivistic research paradigm

The development of positivistic research dates back to the 17th and 18th centuries and it was developed as a way to enable scholars to shift from social sciences to discover empirically-based facts through experiments (Park et al., 2020). Galileo and Copernicus are the early scientists who contributed towards the positivist view (Park et al., 2020). The positivists' paradigm is also known as a scientific method of doing research and is associated with quantitative studies (Wijesinghe, 2011). It involves working with social reality that can be observed (Saunders, 2016); therefore, the results can be measured by observation (Gray, 2013). The data from quantitative studies consists of numbers, calculations, and analysis attained by applying statistical methods (De Villiers, 2005).

The scientific research paradigm aims to investigate, approve and predict law-like patterns of behaviour, and is usually used in research to test theories or hypotheses in the particular study (Taylor & Medina, 2013) by using measurable instruments such as surveys, questionnaires, and other methods (Asghar, 2018) to assess and validate a hypothesis (Xinping, 2014). The emphasis with positivist research is on the verification of hypotheses (Kroeze, 2011a). Positivists argue that there is only one true reality that can be defended, identified, and measured (Ponterotto, 2005). Therefore, the results are based mainly on experimentation (Rehman & Alharthi, 2016).

Ontologically, the position that is maintained is that logical deductive reasoning, scientific inquiry, and replicable findings will ultimately intersect independent truth that is understandable (Plack, 2005). Positivism normally involves only one precise reality (De Villiers, 2005; Krauss, 2005; Wijesinghe, 2011). Xinping (2014) maintains that, in positivist research, the reality is independent and external, and individuals who attempt to find it, can discover it. Therefore, our senses cannot mediate reality

and there are indisputable laws that administer it (Rehman & Alharthi, 2016). The view that is adopted of the world is based upon the idea that the world exists as an outside reality (Kroeze, 2011a). Scholars who adopt this particular view believe that research can be repeated (Wahyuni, 2012). The relationship that exists between the researcher and participants is objective and dualistic (Ponterotto, 2005).

The epistemological assumption with positivist research is that rigorous application through the process of collecting data empirically can be used to acquire knowledge (Burnett & Ishwar, 2012). The assumption concerned with generalizing the theory to diverse situations is uncritically handled on many occasions and not applied correctly, including non-positivist investigations (Howcroft & Trauth, 2005). Preference is based on using scientific approaches by producing numerical measurements to produce suitable knowledge (Wahyuni, 2012). Furthermore, the claim is that observations and experiments are regarded as the only methods to acquire objective knowledge about the social world (Johannesson & Perjons, 2014).

Pather and Remenyi (2005:77) state that a substantial amount of IS research has been carried out using the positivistic research tradition because most of the academics who are presently active in IS research come from technical backgrounds such as engineering, physical sciences, and mathematics. Orlikowski and Baroudi (1991) maintain that particular aspects are concentrated on the IS phenomenon when a positivist research approach is adopted. This view is influenced by the dominance of using positivist research which results in only a partial view that is exclusive (Orlikowski & Baroudi, 1991). The practice of IS, our understanding of information systems, and the theory thereof are affected by this partial view (Orlikowski & Baroudi, 1991).

2.2.2 The interpretive research paradigm

Interpretive research originates from the social sciences and is used in educational research as well (De Villiers, 2005). It draws extensively from qualitative data (Bhattacharjee, 2012). This paradigm was established as a criticism of positivism as it allows individuals to express themselves (Mack, 2010). Interpretivists believe that reality is created by social actors and individuals' viewpoints (Wahyuni, 2012). In the same fashion, this type of research tries to find out what can be figured out about the

social world and it acknowledges numerous realities (Burnett & Ishwar, 2012). Furthermore, interpretive methods of research adopt the position that our knowledge of reality is constructed socially by individuals (Walsham, 1995). The researcher needs to work closely with the participants to understand their meaning and views (Iivari, 2018). Moreover, the researchers value interacting and having a dialogue with the participants in the study to understand the social world from their practical encounters and subjective meanings that people attach to it (Putnam & Banghart, 2017; Rahi, 2017; Wahyuni, 2012). The focus is placed on constructing theories and systems such as conceptual frameworks (Xinping, 2014). The researchers, in this case, prefer to work with qualitative data because it offers substantial clarification of social concepts (Wahyuni, 2012).

The ontology of interpretivism takes the stand of relativism (Scotland, 2012). Ontologically, interpretivists believe that the world can be observed from multiple views (Clarke, 2009). In other words, the reality is perceived by various individuals and these individuals interpret incidents differently, thus offering various viewpoints of the same event (Mack, 2010:8). The purpose is to discover new interpretations or underlying meanings and it conforms to the ontological assumption of multiple realities that are reliant on time and setting (De Villiers, 2005; Kroeze, 2011a). Therefore, people who have had an encounter with certain phenomena have multiple interpretations of the reality; the researcher does not attempt to single out a particular truth from the participants' realities nor does he or she attempt to accomplish outside validation of his or her analysis (Ponterotto, 2005). According to Mack (2010), critics of interpretivism argue that the ontological assumption is subjective rather than objective.

Scotland (2012) maintains that interpretive epistemology is one of subjectivism, which is grounded on real-world phenomena. Considering that interpretivists try to make sense of multiple worlds, it may be deduced that its main emphasis is definitely epistemological (Kroeze, 2011a). This approach does not substitute the responsibility of normative investigation because it dismisses the claim that there are definitive philosophical realities beyond what can be seen (Clarke, 2009). The normative investigation approach is typically employed when the problems being

addressed and the nature of the inquiry are inherently prescriptive (Fullwiler *et al.*, 2009).

The motivation behind interpretive research is to create new, rich understandings and the clarity of social worlds and settings (Saunders, 2016). According to Wijesinghe (2011), understanding the associated phenomenon produces knowledge that is derived from the data of the study. He further asserts that researchers collaborate with the participants of the study to collect data.

Interpretivists apply qualitative methods which comprise of the use of techniques such as case studies, interviews, observation, and textual analysis, which provide understandings into cultural formation, organizational practices, and human interactions (De Villiers, 2005). As a result, interpretive methods produce deep understandings of how people behave, clarify what the participants do from their point of view, and do not dictate to the participants (Scotland, 2012). Moreover, interpretive researchers favour studies that reveal inside opinions or actual definitions of social phenomena from the participants of the study as part of the knowledge that can be of use for the benefit of society (Wahyuni, 2012). Accordingly, natural reality and social reality are regarded as distinctive from other studies and as a result, diverse methods are needed (Gray, 2013). According to Gray (2013), natural sciences look for consistencies in the data to ultimately formulate 'laws', whereas the social sciences frequently deal with the actions of the individual. In interpretive research, new research settings and recommendations are produced to enable ongoing research (Kroeze, 2011a).

Klein and Myers (1999) developed a set of principles to establish the criteria for conducting and evaluating interpretive field studies in information systems. IS research can be considered as interpretive if the knowledge of reality is gained from social constructs such as documents and shared meanings (Klein & Myers, 1999). In order for the readers to evaluate the process and conclusions of the researcher, Malaurent and Avison (2017) argue that the process of the interpretation should be transparent and they suggested that the reflexivity process should be formalized. They further suggested how their guidelines could be added to Klein and Myers (1999) principles. They, therefore, proposed reflexivity to enhance interpretive

studies. Reflexivity helps in understanding the researcher's personal reflections and the analysis of his or her interpretive process in order to understand the personal understanding of the research (Malaurent & Avison, 2017). This element of reflexivity is important, especially for studies that are comprised of reflective practice. The researcher works closely with the subjects to capture their meaning and point of view.

Interpretive knowledge is shaped by a lengthy procedure of interactions that are undertaken by ethnographers who engage themselves within the culture they are studying (Taylor & Medina, 2013). This method does not replace the role of normative investigation, since it rejects the claim that there are ultimate philosophical truths beyond what we see (Clarke, 2009).

2.2.3 Design science research paradigm

The origin of DSR is from engineering and other applied sciences (Dresch et al., 2014). Additionally, this type of research is common in various practices such as information technology, architecture, engineering, and education (Hevner et al., 2019; Kuechler & Vaishnavi, 2011; Kuechler & Vaishnavi, 2012). The emphasis on design science research (DSR) is to design and deploy innovative artefacts (Hevner et al., 2019). Artefacts are examined as answers to practical problems that people experience in their practices (Johannesson & Perjons, 2014).

A discussion of DSR starts after identifying a gap in settings, where traditional sciences were only used to coordinate some investigations (Dresch et al., 2014). According to Johannesson and Perjons (2014), DSR starts when the researcher realizes that something is inappropriate with the world, and it needs to be changed. They emphasize the fact that a new artefact must be presented to make a difference and to make the world better. Similarly, Hevner (2007) states that quality DSR usually begins with the establishment of the practical application of environmental settings regarding opportunities and challenges. DSR is the paradigm for designing artefacts as compared to other paradigms like positivist, interpretivism, and critical social theory that do not bring about the design, development, or produce new artefacts (Venable et al., 2016). IT artefacts must deal with significant problems that

are informed by DSR knowledge (Hevner et al., 2004). Therefore, it is a problem-solving paradigm (Hevner & Chatterjee, 2010).

Bunge (2003) presented a proposal to classify the variations in the development of artefacts and natural sciences. The tension about the ontological assumptions of DSR, that it is a separate paradigm or a paradigm on its own, is subject to continuing debate. Researches such as Drechsler and Hevner (2016); Gregor and Hevner (2013b); Myers and Venable (2014) in the field of IS, consider DSR as a separate paradigm. Dresch et al. (2014) draw our attention to the fact that Information Systems was the area that displayed faster development with regard to the usage of DSR as an epistemological paradigm for advancing knowledge. Jones et al. (2016:296) when engaging in the ongoing debate, assert that

“There remains no independent, epistemic basis to establish design as a recognizably independent discipline, or even identification of epistemological tendencies that have stronger relevancies to design processes than others”.

Other scholars argue that “current dominant philosophical assumptions are inadequate for design science research” (Deng & Ji, 2018:6).

Lukyanenko and Darcy (2016) are of the opinion that the main problem is based on the observation of how the inherent qualities of the artefact and the justifiable inductive reasoning are implemented and utilised. These assumptions do not make an impact or influence this study because the study does not seek to create an artefact and therefore, design science paradigm was not utilised.

DSR has positioned itself as an epistemological paradigm that can guide research toward solving the problems and the design of an artefact because it can assist to decrease the current gap between theory and practice by advancing the significance of the practical field (Dresch et al., 2014). Artefacts and endorsements as such do not have a truth or truth-like value, but contain proclamations about their effectiveness and efficacy (Iivari, 2007). Epistemologically, DSR is described as a knowing-through-making paradigm and ontologically as socio-technologically enabled by solving social issues through technology (Vaishnavi & Kuechler, 2004).

The primary focus of Information Systems is on IT applications and consequently, Information Systems as a DSR should be grounded on a sound ontology of IT artefacts, and particularly of IT applications (Iivari, 2007). Applicable ontology and meta-models establish the foundation to formulate theories (Winter, 2008). Purao (2013) expressed concern that there is also a demand to develop creative feedback to the ongoing debate on the questions raised about the DSR ontology, considering that the continual creation of artefacts is significantly changing the world.

Iivari (2007) draws from several sources dating back from 1966 to demonstrate that most of the early research in Information Systems (IS) was focused on developing system approaches and methods. IS research is identified by the design and evaluation of artefacts, which distinguishes it from other fields (Peffer et al., 2018). He further states that it is the rigour to construct IT artefacts that differentiates information systems as DSR from the industry where they build IT artefacts. Hevner and Chatterjee (2010) draw on an extensive range of sources to support the assertion that research in IS has been dominated by studies influenced by IT artefacts on individuals, teams, and organizations. They further state that technological developments are the outcome of innovative, creative DSR processes.

The substance of DSR in IS is to develop knowledge through designing artefacts (Goldkuhl et al., 2017). In IS, DSR is comprised of building broad socio-technical artefacts such as decision support systems, modelling tools, governance strategies, methods for IS evaluation, and IS change interventions (Gregor & Hevner, 2013b). DSR is a substitute or it complements the natural science method that is central in IS research (Arnott & Pervan, 2010). The main contribution of DSR is a new way of thinking about what makes IS research applicable to its different audiences of managers, practitioners, and peer researchers in associated fields (Hevner & Chatterjee, 2010).

The DSR action of constructing IT artefacts is a significant part of prescriptive research in Information Systems (Iivari, 2007). Venable et al. (2012) draw our attention to the fact that the artefact must be assessed to prove that it works. They state that without assessment, outcomes of DSR are unverified declarations that the designed artefacts if implemented and used in practice, will accomplish their

purpose. According to the literature, DSR requires that there should be an artefact that is developed to address an existing problem and that can be evaluated to verify that it accomplishes its objective.

2.2.4 The critical social theory research paradigm

Critical social theory is derived from the assumptions of Marxist theory (Truman et al., 2000). The concern of CST to appropriately solve human aspirations is to find alternative methods to solve immediate social conditions (Ngwenyama, 1991). Improving the condition of humans in this context means liberating people from social and psychological misrepresentations and obstacles to social improvement (Ngwenyama, 1991). The aim is to emancipate those who are oppressed by the system (Scotland, 2012). The researcher acts as an advocate, a change agent who is responsible to argue for and provide direction towards a more unbiased, just, and sustainable society (Taylor & Medina, 2013). Particularly, the current goal of the research is to empower participants to transform the status quo and emancipate themselves from ongoing oppression since the critical social theory is concerned with unequal dissemination of power and the subsequent oppression of suppressed groups (Ponterotto, 2005). As a result, knowledge is socially constructed and influenced by the authority of connecting society from within (Scotland, 2012). Ultimately, critical social theory supports a reality formed by race, culture, gender, social, and political standards (Ponterotto, 2005). Ngwenyama (1991) affirms that CST should be grounded upon the following five underlying principles:

- People can change their world if they want to;
- Knowledge concerning the social world is socially constructed;
- Reason and critique cannot be separated;
- Theory and practice need to be interrelated; and
- Reason and critique need to be reflexive in practice.

Myers and Klein (2011) as discussed earlier in Section 1.3.2, assert that there are three interrelated elements for conducting critical research. The three elements are insight, critique, and transformation. They describe the elements as follows: the first element, insight, means gaining a wide range of knowledge regarding the present

context before engaging in critical research. This includes, but is not limited to, carefully describing the current context. Secondly, critique is concerned with the lineage of knowledge, the social practices of control and reproduction. The reason for critique is to disclose the normative basis of the current context and the forms of legitimization that rationalize the present social order. Thirdly, with transformative redefinition, the aim is to suggest advancements to the circumstances of human existence, existing social preparations, and social theories.

The ontological stance of the critical social theory paradigm is historical realism (Scotland, 2012). Plack (2005) affirms that critical theorists advocate the view that knowledge or reality is a historical reality. Realities are socially constructed objects that are constantly under internal influence (Scotland, 2012). According to Scotland (2012), the view of the critical paradigm is that language consists of relations of power that can be used to empower or weaken those affected.

The critical social theory epistemology stance is one of subjectivism, which is grounded on real-world phenomena and associated with societal philosophy (Scotland, 2012). According to Ponterotto (2005), the researcher and participants' relationship is subjective and transactional in critical social theory. The aim is to instigate transformation in the participants, resulting in group empowerment and emancipation from oppression (Ponterotto, 2005).

Critical information systems researchers still need to demonstrate how and to what extent the knowledge that is produced informs and is informed by information systems (IS) practice (Howcroft & Trauth, 2005). Critical IS researchers seek an improved understanding of the natural state and to recognize its validity and legitimization by the IS community (Cecez-Kecmanovic, 2005). Therefore, CST is an important part of IS scholarship that studies various structures and power arrangements, and their results (Borena et al., 2015).

Myers and Klein (2011) developed a set of principles for conducting critical research in IS as presented in Section 2.3.1. They developed the principles due to inadequate guidelines that were available for conducting critical research. For the purpose of informing and stimulating transformation in social practices so that the potential for liberation and emancipation of IS can be recognized, knowledge is produced to

explain and reveal how IS is applied or misapplied to improve dominance, control, and oppression by critical social researchers (Cecez-Kecmanovic, 2005).

Critical social theory is viewed as one of the methods of educational research (Rehman & Alharthi, 2016). According to Taylor and Medina (2013), the correctness of critical social theory research is evaluated according to quality standards that are different from the ones used in the positivist paradigm but are the same as the standards of the interpretive paradigm. Critical research should therefore acknowledge its context in terms of culture, history, and politics by promoting equal dialogue relations between researchers and participants (Scotland, 2012). Additionally, the critical social theory framework research process is extremely value refereed (Ponterotto, 2005). Similarly, critical theorists maintain that it is essential to observe further than the views of the participant to the cause of what leads to the development of those perceptions, including the underlying assumptions of the participant and society (Plack, 2005). Accordingly, there is flexibility in critical social theory to adopt any methodology or technique that can help in recommending improvement in the unstable social system (Asghar, 2018). Therefore, it is important to demonstrate critical self-awareness and critical understanding of the complication of social issues that are significant to the researcher (Taylor & Medina, 2013). Moreover, the purpose of critical social theory leads to a different perspective on life in general and on research in particular (Niehaves & Bernd, 2006).

2.2.5 Research paradigm for this study

The objective of the study is to develop Human Computer Interaction (HCI) students as reflective practitioners and the aim is for the participants to construct systems by trying to understand the underlying meaning from their social world. The relationship that exists between the researcher and participant is objective and dualistic in positivism, whereas the relationship in this study is subjective and aims to instigate transformation. Therefore, the positivistic paradigm is not suitable for this study.

The ontological stand of interpretivism is relativism, where individuals interpret the incidents the way they understand them. The interpretive paradigm is based on a deep understanding of the event. This study goes further than merely interpreting the perceived views; it aims to develop each student to their highest potential. The study

does, however, utilise the interpretivism paradigm to interpret the data and to analyse it to make meaning of it but not to guide the study.

The DSR paradigm focuses on the development of an artefact that must be designed and implemented to be utilised in practice to address a specific problem. Therefore, DSR is not a suitable paradigm for this study since the study involves social improvement and not the creation of an artefact.

As part of social emancipation, simple causal ideas are broken down, thoughtful analysis of actions are encouraged, and distortions in practitioner accounts are exposed as a result of ideology and social discourse (Hadfield, 2012). The key emphasis of CST is to search for a practical understanding of the present context as a means to emancipate instead of living under the current conditions (Soja, 1989). The aim of bridging the gap between theory and practice is to reconcile knowledge to satisfy the needs of human beings to improve themselves (Ngwenyama, 1991). Given this understanding, HCI is a practical subject, but it should be taught using both theory and practice. The teaching part of the subject is based on theory to assist the students to pass the main assessments, which are based on the theoretical work and not the practical work. This means that the emancipatory element of being in a position to apply appropriate theoretical work to practice, to enable them to be ready for the workplace environment must be explored to achieve the objective of the study. Therefore, the CST paradigm is suitable for the study. The next section discusses the principles of conducting research (M) in the CST paradigm and also the interpretive research methods that was used for interpreting the results.

2.3 Research principles (M in FMA)

The starting point of justifiable research is to choose the research paradigm (Miskon et al., 2015). The research paradigm or a framework of ideas (F) is applied in the methodology (M) (Checkland & Holwell, 1998). Considering that knowledge is socially constructed in CST (Scotland, 2012), this study is a collaborative exploration where investigations are based on the students' knowledge and background as a means to provide the basis for shared assumptions. The study makes use of

principles for conducting CST research to guide the study given that the chosen paradigm is CST, and also for coordinating interpretive research studies to interpret and to make meaning of the collected data during the analysis process. The principles for performing CST and interpretive studies and how they apply to this study are presented in this section.

2.3.1 Principles of critical social theory

Harvey (1990) emphasizes that there are building blocks upon which critical methodology is based. These building blocks are the principles that are drawn together using different approaches in the deconstructing and reconstructing process. A summary of the critical social theory principles, as suggested by Harvey (1990), is presented below:

1. Abstraction - the assumption with the critical social theory is that the environment where research was carried out to determine the type of data that was generated. Proponents of this theory are of the view that it determines how the researcher understands and interprets the meaning of data. The research attempts to uncover basic structures that extend the nature of abstract concepts.
2. Totality – the totalistic view demonstrates that social phenomena are part of a broader social context, and they must not be analysed separately. An overview of the totalistic view indicates that the elements are linked to a structure and the structure depends on the individual parts that exist.
3. Essence is a major concept that allows the deconstruction process to happen. It is referred to as an important part of the analytical process. In other words, individuals are placed in a position to solve problems.
4. Praxis – the process of research should not be about finding out what is happening but should be about bringing change to the situation. What is known about the phenomenon cannot be changed by the process of reflection, but by taking action.
5. Ideology cannot be separated from the research environment context because its nature must be evident.

6. Structure – this can be reached by identifying the essence of the social connections in its entirety and detaching it from its structure by using the process of dialectical deconstruction and reconstruction.
7. History – the theoretical background found in documented history and the display of the importance of the attributes of the relationship of the framework that gradually becomes evident by itself.
8. Deconstruction and reconstruction – in practice, the list of concepts may exist. These concepts are interconnected to each other. The researcher must choose the one that he identifies as a major concept to perform critical analysis, and thereafter reconstruct other concepts from the major concept.

Studies conducted by Myers and Klein (2011) also proposed a set of guidelines for conducting critical field research in information systems. The guidelines were suggested to assist critical researchers to understand the philosophical foundations from the literature of critical research. As part of this study, since the chosen paradigm is a critical social theory, Table 2.1 presents a summary of the proposed set of principles for critical research.

Table 2.1: Proposed set of principles for critical research Myers and Klein (2011)

The Element of Critique
1. The principle of using core concepts from critical social theorists This principle suggests that critical researchers should organize their data collection and analysis around core concepts and ideas from one or more critical theorists. Example: (Ngwenyama & Lee, 1997) use core concepts from Habermas to critique information richness theory.
2. The principle of taking a value position Critical theorists advocate values such as open democracy, equal opportunity, or discursive ethics. These values drive or provide the basis for principles 4 through 6. Example: Adam (2005) looks at how ethics may be more effectively integrated into critical IS

research.

3. The principle of revealing and challenging prevailing beliefs and social practices

This principle suggests that critical researchers should identify important beliefs and social practices and challenge them with potentially conflicting arguments and evidence.

Example: Doolin (2004) considers how a medical information system was supposed to help administrators to ensure efficiency and financial viability, but he challenges the underlying beliefs and assumptions of the system using concepts from Foucault.

The Element of Transformation

4. The principle of individual emancipation

Alvesson and Willmott (1992) state that all critical social theory is oriented toward facilitating the realization of human needs and potential, critical self-reflection, and associated self-transformation.

Example: Kanungo (2004) shows how a field labourer in an Indian village was able to receive credit and training using the data available in the local knowledge centre to improve her standard of living.

5. The principle of improvements in society

This principle suggests that improvements in society are possible. The goal is not just to reveal the current forms of domination, but to suggest how unwarranted uses of power might be overcome (although the critical theorist should not assume any special position of authority). Most critical theorists assume that social improvements are possible, although to very differing degrees.

Example: Kvasny and Keil (2006) make recommendations with regard to how the provision of social services (using IT) for historically disadvantaged groups might be improved.

6. The principle of improvements in social theories

All critical theorists believe that theories are fallible and that improvements in social theories are possible. Critical researchers entertain the possibility of competing truth claims arising from alternative theoretical categories, which can guide critical researchers in their analyses and interventions.

Example: Habermas modified his ideas in response to debates with Foucault and Gadamer. By the same token, Foucault and Gadamer modified their positions.

The principles of interpretive research methodology are presented next in order to understand how to conduct interpretive research studies effectively.

2.3.2 The Principles of interpretive research methodology

Klein and Myers (1999) provided the seven principles presented in Table 2.2 to guide researchers on how to conduct interpretive studies and evaluate the interpretive research studies in the field of information systems.

Table 2.2: Summary of principles of interpretive field research

Principle	Description
The fundamental principle of the hermeneutic circle	This principle suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form. This principle of human understanding is fundamental to all the other principles.
The principle of contextualization	Requires critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged.
The principle of interaction between the researchers and the subjects	Requires critical reflection on how the research materials (or “data”) were socially constructed through the interaction between the researchers and participants.
The principle of abstraction and generalisation	Requires relating the idiographic details revealed by the data interpretation through the application of Principle 1 and Principle 2 to theoretical, general concepts that describe the nature of human understanding and social action.
The principle of dialogical reasoning	Requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings (“the story which the data tell”) with subsequent cycles of revision.

Principle	Description
The principle of multiple interpretations	Requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study. Similar to multiple witness accounts even if all tell it as they saw it.
The principle of suspicion	Requires sensitivity to possible “biases” and systematic “distortions” in the narratives collected from the participants.

The next section is a discussion on how the principles adopted have been integrated into this study.

2.3.3 Application of critical research methodology principles in this study

This section explains how the principles that were indicated in the previous section have been integrated into this study. The principles adopted for critical research and their application in this study are presented in Table 2.3.

Table 2.3: Principles for critical research employed in this study adapted from Myers and Klein (2011)

Principle	Application in this study
The Element of Critique	
The principle of using core concepts from critical social theorists	Donald Schön's model of reflection has been utilised to guide the students toward reflective practice.
The principle of taking a value position	The researcher takes the stance that HCI students have been motivated to apply relevant theories when they carry out practical work.
The principle of revealing and challenging prevailing beliefs and social	Instructors emphasise reflective practice as the component that causes change to occur and where

Principle	Application in this study
practices	students are encouraged to act and think professionally throughout their learning by merging theory with practice from the beginning as an essential component of their learning. (Mann et al., 2009). The research aims to investigate why students do not integrate theory and practice in their work and to explore the usefulness of reflective practice in bridging the gap between theory and practice.
The Element of Transformation	
The principle of individual emancipation	According to Klein and Huynh (2004:8), “emancipation means that more people can achieve their potential to a greater degree”. In this context, HCI students are empowered to realize the importance of applying theory to their practical work. The researcher was emancipated by enhancing the traditional methods of teaching HCI by providing the students with assignments that compelled them to refer to a particular theory when completing the assignments to explore different HCI concepts that were relevant to their work. Students were emancipated by being able to apply the theory they have been taught in their practical work, and being able to always challenge the way they do their work, always asking themselves if they are applying the relevant theory.
The principle of improvements in society	Students developed as lifelong learners through reflective practice, which provided them with skills to survive by always being in pursuit of knowledge. Through lifelong learning at the university, students are taught skills that they used at a later stage to fashion the development of society (Knapper & Cropley, 2000). Developing students as reflective practitioners contributed towards better HCI practitioners who develop usable and better user interfaces when they are working, which, in turn, benefit the industry and

Principle	Application in this study
	ultimately benefit society.
The principle of improvements in social theories	The study contributed to the body of knowledge of the interventions relevant to HCI classes by utilising reflective theories to address the theory-practice gap that is perceived in HCI classes and subsequently developing HCI students as reflective practitioners.

2.3.4 Application of interpretive research methodology principles in this study

This section indicates how the principles of interpretive field research were integrated into this study. The principles adopted for interpretive research and their application in this study are presented in Table 2.4.

Table 2.4: Principles for interpretive field research employed in this study adapted from Myers and Klein (2011)

Principle	Application
The fundamental principle of the hermeneutic circle	The interpretation of the interviews takes into consideration the relationship that emerges between each segment of the interview with the other interviews to establish the meaning of each. The question-answer circle was employed.
The principle of contextualization	An understanding of the social and historical background of the phenomenon of interest for the participants was generated. The participants' interviews were used to reflect the actual context of the study. The previous experience and knowledge of the lecturer regarding the HCI subject was presented.
The principle of interaction	The gaps identified during the early AR cycles led to a better

Principle	Application
between the researchers and the subjects	exploration of the phenomenon into the next cycle, which initiated interaction between the researcher and the participant.
The principle of abstraction and generalisation	Content analysis was used to develop concepts, generate theory, draw specific implications, and contribute to rich insights.
The principle of dialogical reasoning	Guidelines for developing HCI students as reflective practitioners were determined by the existing theory and the actual findings.
The principle of multiple interpretations	During the analysis of the data, the responses of the participants were analysed in order to confirm that the meaning is understood based on the context.
The principle of suspicion	Investigating common characteristics and deviances across different records, the researcher ensured corroboration of multiple views.

The next section presents the research methods (A) for data collection and analysis that apply to this study.

2.4 Research methods (A in FMA)

This section outlines the specific procedures that were followed for the selection of participants, data collection and data analysis procedures, and the justification of the selected procedures. The research paradigms (F) selected for the study, to guide the applications of research methods (A), which are critical social theory and interpretivism, are discussed. The section starts by addressing the history of action research and its application in this study.

2.4.1 History of Action Research

Action research (AR) has generally been an acceptable research method within the social and medical science disciplines since the mid-twentieth century (Baskerville, 1999) and during World War II (Susman & Evered, 1978). At that time, Kurt Lewin was working to archive democratic inquiry within the social sciences (Dickens & Watkins, 1999). Traditionally, Kurt Lewin is thought to be the founding father of action research (Adelman, 1993; Coghlan & Jacobs, 2005; Huang, 2010; Lau, 1997; Susman & Evered, 1978). Lewin and his associates' focus was to understand and change human actions, to reduce prejudice and increase democratic behaviours (Noffke, 1994).

Lewin's concerns regarding unresolved critical social issues were highlighted by Susman and Evered (1978), who emphasized his experimental work on social systems that involved collaboration between professionals and social scientists looking for innovative solutions to bring about necessary changes. His perception concerning action research was to cycle back and forth between the problem situation and the steps of action experiments informed by research (Dickens & Watkins, 1999). The original model had six phases, including analysis, fact-finding, conceptualization, planning, implementation of the action, and evaluation (Baskerville & Wood-Harper, 1996). However, literature has emerged that contradicts the findings relating to Kurt Lewin as the founder of action research. Gunz (1996) suggests that foundation action research has many roots. He claims that the work of Jacob L. Moreno has been ignored in the scientific community even though he was a creator in developing action research. Gunz (1996) posits that acknowledging Moreno as the founder of action research requires recognising it as a social process involving incorporation, where individuals collaborate to bring about transformative changes in society. Given these points, more scholars recognise Lewin's contribution to action research rather than Moreno's (Noffke, 1994).

It is clear that the action research movement has its roots in the efforts of many people in education, and it shares those roots with many other disciplines (Noffke, 1994). According to Brydon-miller *et al.* (2003), the history of action research is complicated, since it is not based on one educational field but is a research method

that emanates from various fields, such as the work of John Dewey from his philosophical work and educational studies (Kapenieks, 2016), Kurt Lewin's intention to liberate several social scientists (Lewin, 1946), and Sol Tax's interest to collaborate stakeholders, and democracy procedures (Tax, 1975). This demonstrates that the phenomena under investigation are influenced by the researcher's knowledge and interest in the situation.

2.4.2 The action research process

Action research (AR) is an orientation to knowledge creation that arises in a context of practice and requires researchers to work with practitioners (Huang, 2010). This method is used as an example of a post-positivist social scientific research method, which is suitable for studies that involve technology in the context of humans (Baskerville & Wood-Harper, 1996). It merges research and praxis, thus producing relevant research findings (Baskerville & Wood-Harper, 2016). The central idea is that AR uses a scientific approach to study the resolution of important social or organizational issues together with those who experience these issues directly (Coghlan & Brannick, 2019).

According to McNiff (2013), the purpose of undertaking action research is to generate the type of knowledge that contributes to sustainable personal, societal and environmental wellness. In its initial formulation, 'action research' was defined as a method that enabled theories produced by the social sciences to be applied and tested in practice based on their practical effectiveness (Carr, 2006).

AR is conducted to improve the practice of lecturers and their students' learning experiences (Efron & Ravid, 2019). The practice-inquiry combination at the heart of the work aims to make a situation such as a classroom or the entire university system better by responding to the continuous need for development or change (Mertler, 2019). In this research context, students were involved in projects that enabled them to learn by practicing, in other words, they were active participants who were going to apply theory in their practice.

Action researchers do not readily separate understanding and action; rather, the argument is that only through action is legitimate understanding possible; theory

without practice is not theory but speculation (Huang, 2010). Attention is focused on the fact that participants play an active role in organizing and effecting change by making an impact on the process (Oprešnik & Dolinšek, 2012).

The five iterative phases of action research are diagnosing, action planning, action taking, evaluating, and specifying learning as illustrated in Figure 2.2 (Baskerville, 1999).

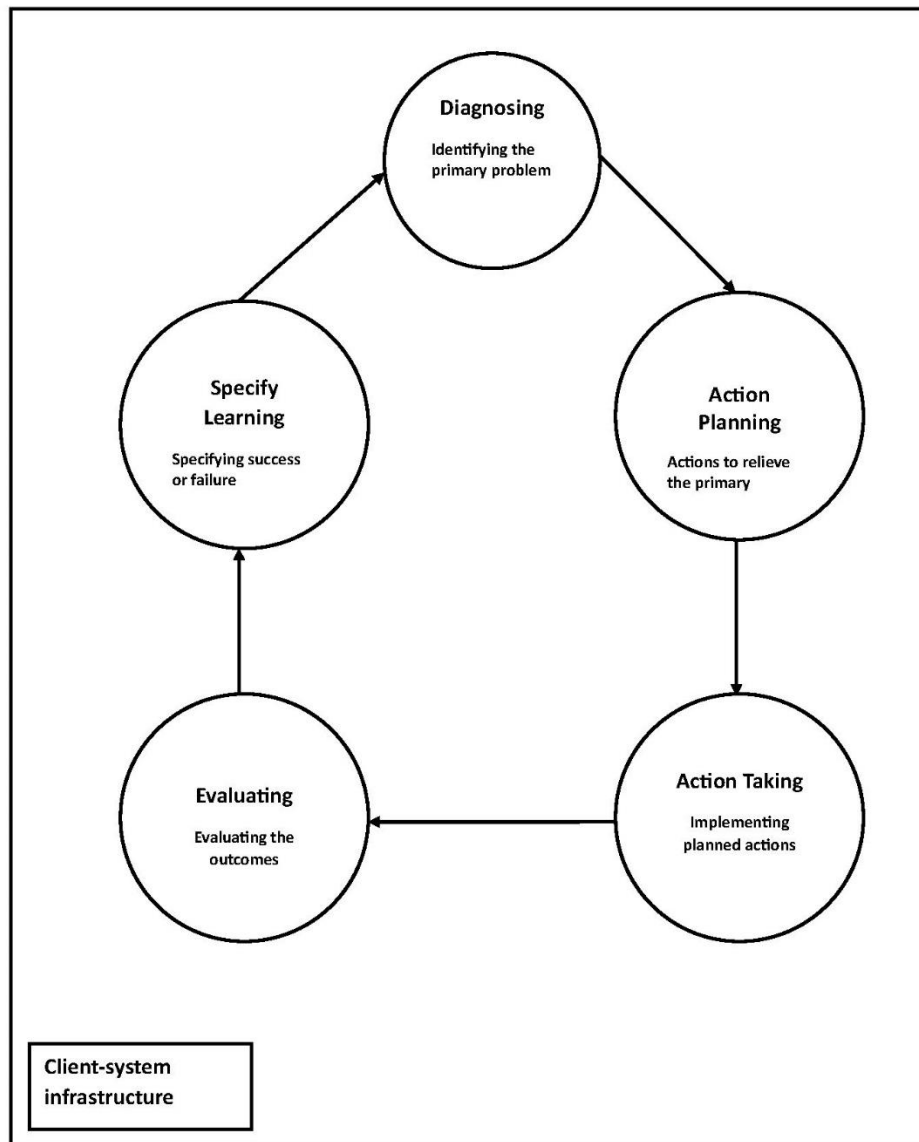


Figure 2.2: The action research cycle (Baskerville, 1999)

According to Baskerville and Wood-Harper (2016), the three distinguishing characteristics of action research are that:

1. The researcher is an active participant in the process, with the expectation that both the researcher and the organization will benefit.
2. The knowledge acquired can be applied immediately.
3. The research process is cyclical, linking theory and practice.

Knowledge is developed whether the action research cycle was successful or not (Checkland & Holwell, 1998). The next section presents how action research was applied in this study.

2.4.3 Application of the action research process in this study

This study applied an iterative process involving five action research cycle phases. These five phases are illustrated in Figure 2.2 and were applied to this study as follows:

Diagnosing

The diagnosing phase aimed to present a reflection on the findings of the previous cycle in terms of student development and guideline development and verification.

Action Planning

The results from the diagnosis stage were used to plan the action that would be undertaken for the cycle.

An action plan was developed after conducting a literature review to present possible interventions which would develop the RP skills of the HCI students guided by guidelines and to verify the practicality of any unverified guidelines.

The action plan would consider learning strategies that would assist in making connections between theory and practice.

Action Taking

To present detail of the actual interventions in the specific research environment based on the possible interventions subject to the constraints in the environment whereby:

- students completed assignments which would assist with reflective practice;
- students were required to complete the assignments to carry out the application of theory to practice; and
- the critical social theory was integrated with developing students as reflective practitioners.

Evaluation

- To present the data collection and analysis of an interpretive investigation aiming to investigate the success of the intervention both in terms of student development and guideline verification.

Specifying Learning

Learning was specified as follows:

- To present the findings of the evaluation phase in terms of student development and guideline verification and development of additional guidelines.

Brydon-miller et al. (2003) describe action research as a work in progress, and therefore, the results from specifying learning can be used for other iterations. The intended results of action research contribute to scientific knowledge and theory and offer significant learning from outcomes that are not simply the solutions to immediate problems (Coghlan & Brannick, 2019).

The next section presents a description of the study participants.

2.4.4 Study participants

The participants for this study were students registered at the Central University of Technology. The target group comprised students registered for a graphic design course at the second-year level in the IT programme. There were two groups of participants; the first group was involved in the diagnosis phase, and the second group was involved in the planning and evaluation phases of the action research cycle. There was a difference of one year in terms of the years in which the groups were registered for the module. Purposive sampling was used based on the characteristic that the students were doing HCI content as part of the subject.

Data were analysed once collected from the participants. The next section addresses how data was collected from the participants in this study.

2.4.5 Data collection

The study aimed to develop students as reflective practitioners. In an effort to understand the development of the students as reflective practitioners, they were requested to complete the reflective pages after receiving feedback for their assignments or to reflect on the assignment they were about to undertake. This process was done to allow students to apply reflection-in-action and reflection-on-action, as proposed by Schön (1983b), and to determine which method works best to assist in the reflection process. They were asked to reflect on the task that they had to carry out or on their performance after receiving feedback.

For the purpose of diagnosing the problem, the diagnosis stage of action research was performed a year ahead of performing the other action research cycles. The collection of data at this stage gave the researcher a holistic view of the situation. The researcher also had an opportunity:

- to plan how to address the identified issues appropriately;
- to analyse how students carry out practical assignments; and
- to incorporate different methods of teaching and learning HCI.

The process began with some general questions to establish whether the students applied the theory when they carried out the practical assignment and were asked to reflect on their performance. The results are presented in the diagnosis chapter (Chapter 3).

As part of an effort to develop students as reflective practitioners, the results from the diagnosis stage were used to plan a subsequent cycle of data collection. The plan developed from the diagnosis results was applied to newly registered students the following year. These students were given a chance to reflect on their assignments using different strategies. They were asked to reflect on the task that they had to carry out or on their performance. This was done over a period of two semesters to allow the students to gradually develop reflective skills. During the evaluation phase of the action research cycle as illustrated in Figure 2.2, interviews informed by literature were conducted when the students had completed their final project, to determine if they had developed as reflective practitioners.

According to Hennink et al. (2020), qualitative research is concerned with investigating what people go through in their lives through a description of the events and applying an appropriate set of research methods. The research methods that can be used in qualitative research are:

- *In-depth interviews*, which give the researcher a chance to hear the viewpoints and experiences of the respondents and offer a chance to explore the opinions further (Harding, 2018);
- *Focus group discussions*, which are a method where a group of participants with similar backgrounds meets with the facilitator to discuss a particular topic of interest (Carey & Asbury, 2016), to understand societal affairs better (Nyumba et al., 2018);
- *Observation*, where the participants are observed from a distance without any interaction with the researcher. The researcher is careful to not interfere with what is happening or impact the behaviour of the subjects (Silverman, 2016);
- *Narrative data*, which is gathered through narrative inquiry, which is an interdisciplinary field that is concerned with the stories people share in their everyday lives. It is based on the assumption that humans are storytelling creatures by nature, and they make sense of their ever-changing world through those stories (Flick, 2017);
- *Visual methods*, which involve visual perception consisting of what the material world reflects, and the interpretations humans make. This includes images produced either by the researcher where the researcher is the one who takes photographs, or by the participants. Another method is the use of images produced by actors for other purposes, which can be obtained from the photo archives or the internet, or both. The images may be in the form of still images or videos (Flick, 2017);
- *Life histories or biographies* are a method where a researcher and a participant collaborate to write a life history, or an individual reflecting on his/her own life (McLaughlin, 2017); and
- *Collecting documents* includes diaries, written life histories, letters which are referred to as a primary source of data, and field notes, interviews, schedules,

questionnaires, and transcripts which are produced using documentation (Silverman, 2016).

- *Written interviews* - As technology advances, multiple options for data collection are available, such as telephone, videoconferencing, email, and text messages (Oltmann, 2016)

In this study, data were collected in the form of documents using reflective sheets as well as interviews.

Collection of data from documents in the form of reflective pages was carried out at the diagnosing phase to guide the development of the study and at the action-taking phase using the literature as the foundation. According to Hawkins (2018), participants are able to reflect on their answers when they reply in writing.

Written interviews were used during Cycles 1 and 2. In-depth interviews using standardised open-ended questions were used to allow the participants to provide as much information as possible. All participants were asked the same set of questions. Follow up questions were used to clarify statements so that the perspective of the participants could be accurately reflected. Oral interviews were transcribed into written text to allow the data to be analysed (Nascimento & Steinbruch, 2019). A text-to-speech application was used during the interviews to convert the spoken word into written text.

Table 2.5 presents a summary of how the data was collected during different cycles of the action research.

Table 2.5: Summary of data collection for this study

Section	Summary
Diagnosis phase (Chapter 3)	Chapter 3 provides context into the respondents' views on how they perceive their performance and the process they took to complete the assignment, which indicates that reflective practice is needed in HCI classes. This chapter answers the question, "What are the current problems in HCI classes?"

Section	Summary
Cycle 1: Developing reflective practice skills (Chapter 6)	Reflection-on-action is applied in this chapter implicitly. The plan was for the students to complete the reflective sheet after submitting the assignment. This planning phase was designed to empower students to develop reflective skills by introducing the critical element in their studies to encourage them to examine what they have learned and how are they going to use that knowledge in future before they can submit the assignment.
Cycle 2: Improving reflective practice skills (Chapter 7)	This chapter applied reflection-in-action implicitly. The plan was for the students to have the reflective sheet before they started with the assignment. This second planning phase was developed to instigate reflection before and during the process of completing the assignment with the purpose of encouraging students to apply reflection during the process of completing the assignment.
Cycle 3: Evaluating reflective practice skills (Chapter 8)	The chapter evaluates whether students achieved the knowledge of Human Computer Interaction as planned, and also determines if they developed reflective practice skills. The analysis of the interviews determined if they still understood what reflective practice was and whether they applied it in other modules' projects/assignments and continue to apply it.

The next section presents how the collected data were analysed.

2.4.6 Data Analysis

After the data had been collected, they were analysed to gain meaning. Qualitative data analysis can be inductive or deductive. Inductive analysis refers to the analysis of data collected during the study and deductive analysis refers to an analysis that is guided by the theory and frameworks (Brooks et al., 2018). Various methods are used to analyse qualitative data:

- Documentary analysis is an approach applied to material such as public records, newspapers, letters, and diaries by undertaking the original analysis of the document rather than simply reviewing its content (Harding, 2018), which includes:
 - Content analysis is an analysis concerned with the methodological process of categorizing text material, images, and symbols (Krippendorff, 2018). According to Weber (1990), content analysis organises text information into applicable and manageable small segments of data;
 - Discourse analysis is the study of language, in an everyday sense (Johnstone, 2018); and
 - Critical discourse analysis refers to a type of discourse analytical research that primarily studies the way social power abuse, dominance, and inequality are endorsed, replicated, and resisted by text and talk in the social and political context (Van Dijk, 1993).
- Interpretation of images applies to the visual observation of images. Images are material artefacts that a person can touch and see, then inspect what material they are made of (Flick, 2017);
- Hermeneutics is a theory used for interpreting meaning when studying text (Bleicher, 2017);
- Conversation analysis is used to analyse the social conversational interactions using normal conversations (Hoey & Kendrick, 2017); and
- Narrative analysis focuses on the context in which the story takes place and what the narrator has considered to include in the story (Forrester & Sullivan, 2018).

Content analysis was used in this study. Codes were derived from the answers from the reflective sheets and the interview transcripts. The follow-up questions were used to extract deeper meaning and to understand the participants better. The answers from the follow-up questions were not included in the codes as they were only used to state the perspective of the participant in a clearer manner.

According to Mayring (2004), the data needs to be analysed one step at a time in content analysis. The content analysis process that was followed in this study as outlined by Zhang and Wildemuth (2009) is presented in Table 2.6.

Table 2.6: Content Analysis process presented by Zhang and Wildemuth (2009)

Process of content analysis	Significance of the process
1. Preparing the data	Transforming the data into written text before starting with the analysis.
2. Defining the unit of analysis	The unit of analysis refers to classifying the basic unit of text during content analysis. Independent themes are normally used in qualitative content analysis.
3. Developing categories and coding schemes	Categories are derived from the data, previous related studies, and theories.
4. Testing the coding scheme on a sample	Developing and validating the coding scheme early in the process. These can be done by coding the sample of the data to test for clarity and consistency of the category definitions.
5. Coding all the text	Application of the coding rules to the entire text when sufficient consistency is achieved.
6. Assessing consistency	Re-examine the coding consistency when done with coding the entire text.
7. Drawing conclusions	Make sense of all the categories and themes identified including their properties. Also, by making inferences and present the reconstructions of meanings derived from the data
8. Reporting methods and findings	Present research findings.

Cultural, social, economic, or background context influences how individuals interpret the meaning and also determines how data is analysed (Krippendorff, 2018). In many disciplines, content analysis is widely used to analyse various forms

of communication, especially text-based communications (Stepchenkova et al., 2009). There are three distinct approaches to conducting qualitative content analysis which are conventional, directed, or summative (Hsieh & Shannon, 2005).

The conventional approach is normally used in studies to describe the phenomenon (Hsieh & Shannon, 2005). In conventional content analysis, instead of imposing predetermined categories on the data, categories are derived from the analysis. This type of approach is suitable when a theory is available or research literature on a phenomenon is inadequate (Hsieh & Shannon, 2005).

In the directed approach, the analysis includes applying conceptual grouping to a new context (Humble, 2009). Directed content analysis starts with a theory (Seker & Guney, 2012). Codes are developed from relevant theory and defined before and during data analysis (Hsieh & Shannon, 2005). The directed content analysis differs from other content analysis because it uses an existing framework to determine an initial coding scheme and the result of the analysis validates or extends the theoretical framework (Hsieh & Shannon, 2005). According to Hsieh and Shannon (2005), two strategies can be used to code when using directed content analysis. The first strategy involves reading the transcript and highlighting all text on the first impression that appears to relate to predefined codes influenced by prior research findings or theory. The second strategy is to start to code right away using the predetermined codes without highlighting the text first. The second strategy is also supported by Assarroudi et al. (2018) in their studies because it offers a chance to recognise missing text associated with the predefined codes and emerging codes and it improves the reliability of the results.

A summative approach is where the content or words are counted and that quantification is then interpreted (Humble, 2009). Identification and quantification of keywords are used to analyse text to understand the use in the present context (Hsieh & Shannon, 2005). The interpretation and sorting of the keywords are based on the relationship of data, thus forming categories and subcategories (Sjölin et al., 2015). Finally, the keywords are counted to demonstrate the allocation within categories (Sjölin et al., 2015).

The major coding differences between the three approaches are presented in Table 2.7.

Table 2.7: Major coding differences between three approaches to Content Analysis (Hsieh & Shannon, 2005)

Type of Content Analysis	Study Starts with	Timing of defining codes or keywords	Source of codes or keywords
Conventional content analysis	Observation	Codes are defined during data analysis.	Codes are derived from data.
Directed content analysis	Theory	Codes are defined before and during data analysis.	Codes are derived from theory or relevant research findings.
Summative content analysis	Keywords	Keywords are identified before and during data analysis.	Keywords are derived from the interest of researchers or review of literature.

In this study, conventional content analysis was utilised, where codes were derived from the data. The identification and grouping of the data to form the codes by reviewing each participant's transcript was performed to establish order among words and sentences that contribute to the same meaning.

The coding process is explored further in the diagnosis phase of the action research cycle. The research plan for this study is presented in the next section to give an overview of the study.

2.5 Research Plan

In Figure 2.3, the research plan is presented to illustrate what has been discussed in this chapter regarding the methodology.

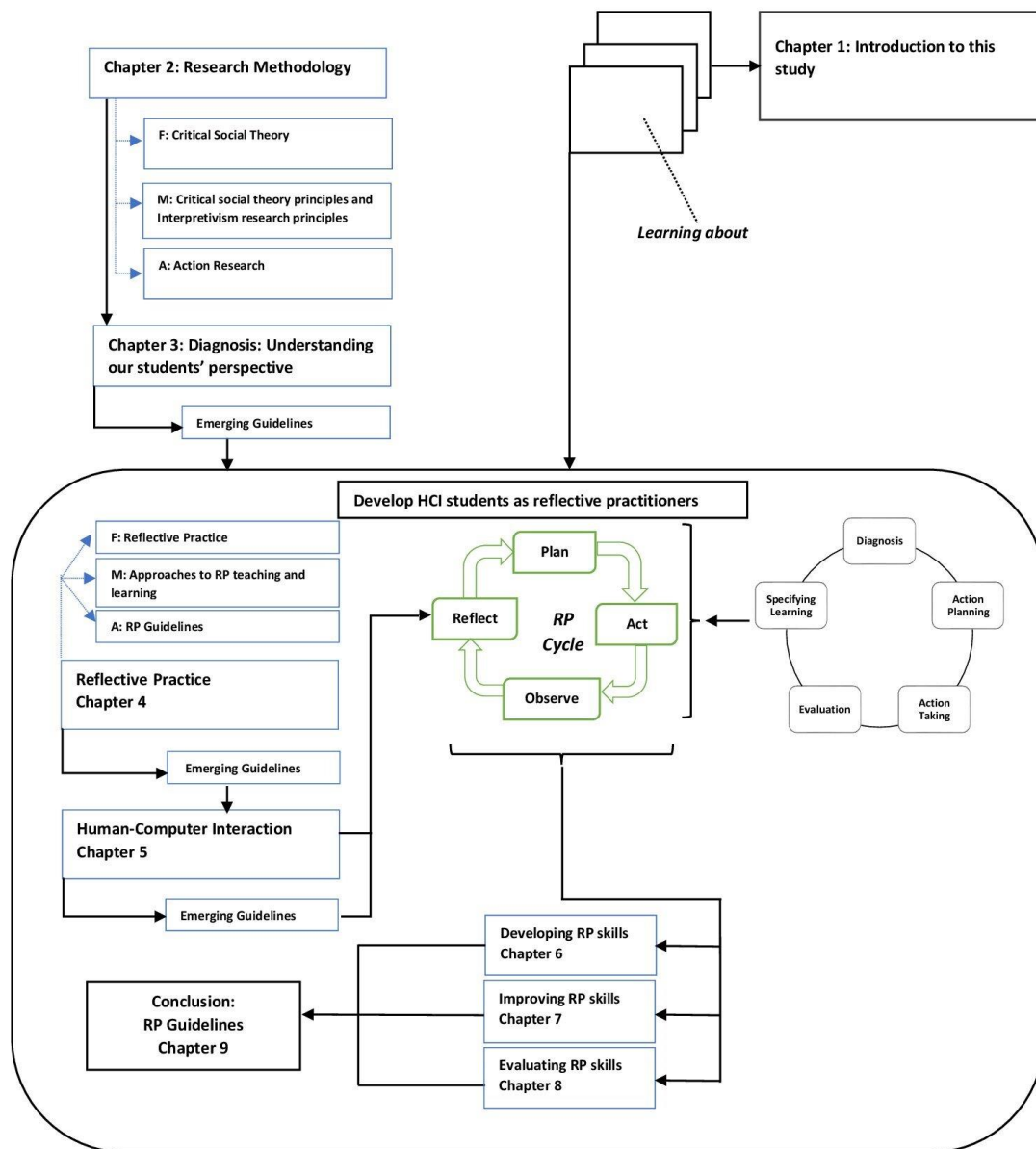


Figure 2.3: Research plan for this study

The aim of the research was to formulate guidelines to develop the HCI students as reflective practitioners. The area of concern (A), i.e., the problem that the research sought to address, is that students do not reflect on their work, and they treat theory and practice as separate components. Critical research principles (M) developed by Myers and Klein (2011) are applied to an area of concern (A) to relieve the problem. In an attempt to bridge the theory-practice gap, the study started by diagnosing the

problem in order to address it appropriately in Chapter 3. The first set of the guidelines was derived from the data collected from the participants. A literature review was conducted in consecutive chapters to formulate the plan based on theory. Chapter 4 presents an overview of current research and discussions on the application of RP as a framework of ideas. The guidelines towards developing HCI students as reflective practitioners were derived from RP literature. Chapter 5 presents an overview of current research and discussions on the application of HCI as a framework of ideas. The guidelines towards developing HCI students as reflective practitioners were derived from HCI literature.

The purpose of the empirical work is to present the detail of an initial investigation to improve understanding of the experiences of the participants of the study to guide subsequent AR iterations.

The first AR cycle is presented in Chapter 6 to develop the students' reflective practice skills. The guidelines from Chapters 3, 4 and 5 were consolidated and 5 categories were created to guide the instructors on how to develop HCI students as reflective practitioners. The guidelines were tested for their suitability and were either verified or unverified at the end of the chapter. The second AR cycle is presented in Chapter 7 for improving reflective practice skills of the students. The unverified guidelines were used as the inputs in this cycle to further test their suitability to achieve the objective of the study.

The researcher employed reflection-on-action as a first plan in Chapter 6 and reflection-in-action in Chapter 7, both developed by Schön (1983b) as a base to provide the students with an opportunity to experience both during the process of developing as reflective practitioners. Both chapters 7 and 8 include the analysed results from the reflective sheets that students completed. The third AR cycle to evaluate the RP skills of the students is provided in Chapter 8. In order to determine whether the interventions led to emancipation, participants were interviewed. Chapter 9 presents a final set of guidelines to develop HCI students as reflective practitioners. The evaluation of the research principles (critical social theory and interpretive research) employed in the study is also presented.

In order to ensure that the study findings are credible, the strategies followed are presented next.

2.6 Strategies to ensure the credibility of the study findings

In qualitative studies, it is important to adopt strategies to ensure rigour in the analysis, findings, and conclusions. According to Noble and Smith (2015), these strategies include:

1. Take responsibility for personal biases that may have impacted the findings (Morse et al., 2002);
2. Ensure adequate depth and relevance of data collection and analysis, acknowledge biases in sampling and continual critical reflection of methods (Sandelowski, 1993);
3. Demonstrate a clear decision trail and ensure interpretations of data are consistent and transparent through rigorous record-keeping (Long & Johnson, 2000; Sandelowski, 1993);
4. Ensure that different perspectives are represented through the establishment of a comparison case or seek out similarities and differences across accounts (Morse et al., 2002; Slevin & Sines, 1999);
5. Include thick and rich descriptions of participants' accounts to support findings (Slevin & Sines, 1999);
6. Provide clear explanations concerning thought processes during the analysis of data and further interpretations (Sandelowski, 1993);
7. Reduce research bias by interacting with other researchers (Sandelowski, 1993);
8. Invite participants to comment on the interview transcript to do respondent validation and find out if the final themes and concepts created adequately reflect the phenomena being investigated (Long & Johnson, 2000; Sandelowski, 1993);

9. Utilise data triangulation (Long & Johnson, 2000; Sandelowski, 1993), using different perspectives and methods to assist in producing a more extensive set of findings (Fraser & Greenhalgh, 2001; Kuper et al., 2008).

Another strategy is to ensure rigour in action research. Rigour in action research refers to how data are generated, gathered, explored, and evaluated; how events are examined and interpreted through multiple action research cycles (Coghlan & Brannick, 2019).

Melrose (2001) presented the following requirements for data collection methods to ensure rigour in AR, which have also been applied to this study:

- The data collection method must be appropriate for the specific situation and a particular critical research paradigm;
- The researcher must not enforce but negotiate with the participants;
- The researcher includes, involves, and informs the participants;
- The data collection method is practical, inclined to contributing new insight regarding the area of application; and
- The data collection method is structured and sustainable instead of being inconsiderate and random (even though the coincidental data can be beneficial).

The value in action research is not to determine if the change process was successful or not, but rather the way data is examined, that will determine whether a particular change was achieved, offers a valuable and interesting theory that may contribute to learning on the subject of change management (Coghlan & Brannick, 2019).

To ensure rigour in the action research study, five quality principles that are applied in this study as proposed by Heikkinen *et al.* (2012) are as follows:

- *historical continuity* - indicates how the action has historically evolved; how the narrative proceeds in a logical and coherent way (employment) – literature was reviewed to gather historical data, evidence, and perspectives relevant to the study (Chapters 4 and 5);

- *reflexivity* - firstly, it describes the nature of the relationship between the researcher and the research object (subjective adequacy); secondly, the assumptions that the researcher holds about knowledge and reality (ontological and epistemological presumptions); and lastly, how the researcher describes the research material and methods (transparency) – ethical considerations related to the researcher-participant relationship were addressed in Section 2.7 and principles for critical research employed in this study adapted from Myers and Klein (2011) in Table 2.3;
- *dialectics* – how the insight of the researcher has developed in dialogue with others (dialogue); the way different voices and interpretations are presented in the report (polyphony); Authenticity and genuineness are the protagonists of the narrative – reflections of the data collected were documented in Chapter 6, 7 and 8;
- *workability and ethics* – refer to the success of the research when workable practices are created (pragmatic quality); the type of discussions provoked by research (criticalness); the approach in which problems are dealt with ethically (ethics); how the research encourages new practices and actions by making people believe in their capabilities and possibilities (empowerment) – reflective practice was employed to address the challenges that the students were facing on how to bridge the theory-practice gap; and
- *evocativeness* – refers to the way the research is designed to evoke mental images, memories, or emotions that relate to the theme. Principles for critical social theory research and interpretive research are also applied in this study to ensure the credibility of the study findings – the research prioritised the perspectives and experiences of the participants by using written and face-to-face interviews.

These principles are applied implicitly in the AR cycles of the study (Chapters 6, 7, and 8). In order for the study to be trustworthy, the next section presents the ethics as applied to this study to ensure that the researcher conducts and reports research in line with prescribed ethical standards.

2.7 Ethical considerations

According to Schenck (2010), ethics refers to principles, standards, and moral judgments. In the context of research, ethics refers to the standards of behaviour that guide your conduct concerning the rights of those who become the subject of your work or are affected by it (Saunders, 2011). It is concerned with morals, and the emphasis is on questioning what is deemed right or wrong and avoiding harm in a specific setting (Schenck, 2010). The ethical considerations for this study include:

- Voluntary participation - participation in this study was voluntary and there was no threat or harm for non-participation;
- The right to decline to answer any question;
- Preservation of anonymity - the questionnaire did not identify the participants by name in any reports using information obtained from the questionnaire;
- Informed consent - permission was granted in the form of a signature from a consenting party to voluntarily participate in the study;
- Right to withdraw – participants were informed that they could withdraw at any time during the study;
- No harm to participants - no harm was anticipated to participants as a result of their participation in the study;
- Data protection - data from the participants was stored safely to protect it from unauthorized access and was only accessible to the researcher; and
- Ethical governance – In this study, an ethical clearance number was obtained from the researcher's enrolling University as well as an ethical clearance certificate from the University of Technology where participating students were based to conduct the study.

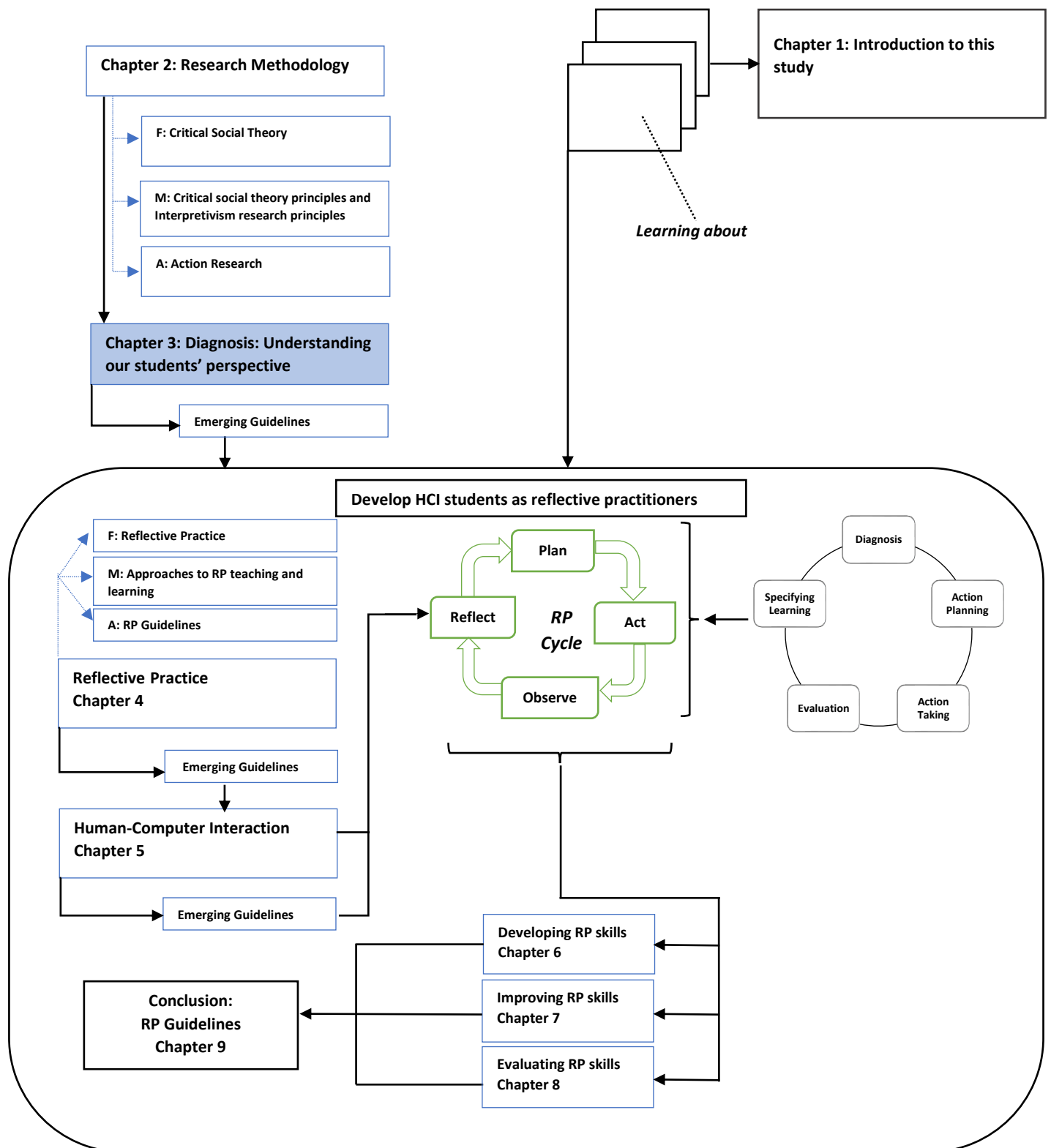
These ethical standards were integrated into the study to develop trust between the researcher and participants.

2.8 Chapter summary

This chapter begins by discussing the paradigms used in information systems and their associated ontological and epistemological assumptions. The justification of the

chosen paradigms is provided. Research principles utilised in the study are specified and an explanation has been provided on how they were applied in the study. The research methods used in the collection and analysis of data are presented. Action research iterative cycles used to gather data, feeding it back into another cycle where the results would then guide proceeding data gathering were presented (Coghlan & Brannick, 2019). Strategies used to ensure the credibility of the study were presented. Lastly, the ethical considerations followed in the study were specified.

The research methodology followed in this study is presented in this chapter. In the next chapter, the focus is on diagnosing the problem to formulate an inquiry by asking the students to complete the questionnaire in the form of a reflective sheet that will assist with examining the problem. The findings will also be presented.



CHAPTER 3: DIAGNOSIS: UNDERSTANDING OUR STUDENTS' PERSPECTIVES

3.1 Introduction

The primary objective of this study is to formulate guidelines for developing human-computer interaction (HCI) students as reflective practitioners. This chapter presents the first stage of the action research (AR) cycle to explore or diagnose problematic situations experienced in the HCI learning environment. The diagnosis of the problem was done so as to gain some understanding of the students' experiences before selecting an appropriate theory to guide the action-taking phase. This investigation represented the viewpoints of those directly affected by the current instructional design of the HCI module, and generated context-related data that were used to improve the situation. Since the researcher diagnosed the problematic situations experienced in the HCI learning environment and gained an understanding of the students' experiences, the process of developing guidelines commenced in this chapter.

The chapter begins by detailing the background of the module and then proceeds to describe how the data were collected. Written questions were given to the students to obtain an overview of the problematic situation from their point of view after receiving feedback on their assignments. The biographical profiles of the participants, which were compiled at the beginning of the research, are also presented in this chapter. Data analysis was conducted using the content analysis process described in Chapter 2. The findings from the participants' responses are also presented in this chapter to guide future interventions. The chapter concludes with a set of guidelines and provides a summary of the chapter.

3.2 Context: Diploma in Information Technology programme

The Department of Information Technology (IT) at the Central University of Technology, Free State (CUT, FS), offers programmes in Software Development and Web and Application development. The university has two campuses: one in Bloemfontein and one in Welkom. The participants in this study were based on the

Welkom campus, where only Software Development was offered. The Diploma in IT is offered in two main streams: a three-year programme and a four-year programme. The difference between the two streams lies in their admission points. The minimum requirement is set at 27 admission points to register for the three-year programme. To be admitted into a three-year programme, the minimum requirements are a 40% pass mark in four higher credit school subjects and a mark of at least 30% in three lower credit school subjects. Students are admitted if they fail one school subject but the other subjects are above the minimum requirements. Additionally, a minimum of 60% mark in Mathematics literacy or 40% in Mathematics or Information Technology is required. A student who qualifies for a three-year diploma can register after completing his/her matric.

The four-year extended curriculum programme (ECP) is designed for students who do not meet the minimum admission requirements to register for the three-year programme. The duration of the diploma is extended by one year and it starts by equipping them with the necessary skills for the Information Technology programme.

3.3 Human-computer interaction module context

Second-year students registered for the Diploma in Information Technology are eligible to register for the HCI module in the first semester without any prerequisite. The content of the module is based on HCI; hence they are referred to as HCI students. The purpose of the module is stated in the learner guide provided to the students (CUT, 2021:11) as follows:

“The purpose of the module is to understand why we must design interactive systems that are enjoyable to use, do useful things, and enhance the lives of the people who use them. We want our interactive systems to be accessible, usable, and engaging. In order to achieve this, the design of such systems should be human-centred. That is, designers need to put people rather than technology at the centre of their design process.

The first part of the module is about the essence of the human-centred design of interactive systems. After studying the first part you should understand the essential features of designing interactive systems. In particular, what interactive design is,

who and what is involved, the organization of content, navigation layout, and use of colour to assist in developing systems that are human-centred to ensure systems are usable and engaging.

The second part will provide techniques to enable designers to do all these things.”

The purpose of the module is to address the content that will be covered. The outcomes of the programme are specified in a learner guide (CUT, 2021:3), and are stated as follows:

“Provide industry with satisfied, well-equipped, and entrepreneurial Information Technologists for the 21st century. The goal is to provide learners with the required graduate attributes to adequately compete in the global workplace or to pursue further studies.”

In order to achieve the learning outcomes, the module consists of 15 credits and the time to be spent on this module is stated as follows (CUT, 2021:3):

- *“Attend **all** theory and practical classes for your specific group. You must attend theory class and practical classes twice a week. This gives you a total of 5.33 hours.*
- *Spend time on the following activities every week:*
 - a. Read the appropriate section carefully before attending the lecture.*
 - b. Study the completed section as soon as possible after the lecture, but at least before the following lecture.*
 - c. Do all the homework assignments given by the lecturer.*
 - d. Make sure that you get all the correct solutions afterward and that you understand them completely.*

These activities take about seven hours per week. Therefore, the total time that you should spend on this subject will be 12.5 hours per week.”

The primary objective of this study is to formulate guidelines for developing human-computer interaction (HCI) students as reflective practitioners. The problem identified by the researcher is that students address theoretical and practical components of HCI as separate units. The guidelines are developed to assist students to reflect on

their actions. The guidelines that emerged from the learning outcomes are specified in Table 3.1. Code GLO is used to represent the guidelines from learning outcomes.

Table 3.1: Emerging guidelines from learning outcomes (GLO)

Guideline code	Guideline
GLO1: Attending classes	Recommend to students to attend all scheduled theory and practical classes.
GLO2: Preparing for lecture	Ask students to prepare thoroughly for the lecture by reading the relevant section before attending.
GLO3: Studying after lecture	Request students to review the section after the lecture before the next one.
GLO4: Completing assigned work.	Advise students to complete all the assigned work.
GLO5: Acquiring correct answers	Ask students to get accurate answers afterward and have a thorough understanding of them.

The guidelines were consolidated and grouped during the first AR cycle with other guidelines that will emerge from this chapter and literature chapters (Chapters 4 and 5). The assessment plan comprised both formative and summative evaluations. The formative assessments include one practical assignment and two theoretical tests, which contribute 60% to the formative course mark. Practical assignments account for 40% of the course marks. The two theoretical tests comprised a class test and a main test. The class test counts for 25% and the main test counts for 35% of the course mark. The summative assessment was conducted at the end of the semester and included one examination mark. The final mark is based on a 50/50 split between course and examination marks. All students received feedback on their assessments during face-to-face or online class sessions. The method in which classes are conducted was based on the alert level announced by the South African president due to the COVID-19 situation. Students who did not attend the feedback sessions were also able to obtain the suggested solution from the learning management system.

This chapter aims to understand students' perceptions of how theoretical class activities relate to their practical assignments. Their reactions when receiving feedback on their assignments provide an indication of their understanding of the relationship between the theory they learned in class and the application thereof in practical work. The process and findings of the interpretive investigation are reported in the next section to support the selection of an appropriate guiding theory for the intervention phase of the first iteration of AR.

3.4 Diagnosis phase: Towards understanding the underlying problem

Interpretive research was conducted to develop an initial understanding of what students perceived as the relationship between class activities and practical assignments. The results of this investigation were used to identify a theoretical framework for developing an action plan for the first AR iteration.

After lecturing the module for several years, the researcher observed that students were failing to apply the theory they were being taught during practical sessions as required. Their approach when dealing with different components of the module seemed to separate theory and practical work. This might be one of the conceptual barriers experienced by the students.

To diagnose the problem, a specific instructional design was implemented at the start of the semester, focusing on student involvement during theory classes, followed by practical assignments. Students who volunteered to participate in the research were asked to review their performance expectations and experiences relating to practical assignments. The investigation was conducted after receiving the students' feedback. The practical work and assignment of HCI are based on applying the relevant design principles taught during theory classes.

3.4.1 Diagnostic investigation: Instructional design

In terms of the specific instructional design used for this investigation, a theory session was scheduled that began with the introduction of the basic concepts for creating interactive systems and the historical background of HCI. During the second theoretical class, students were introduced to the people, activities, contexts, and

technologies (PACT) framework for thinking about design situations, which involves understanding the relationship between activities and technology, the setting in which they occur, and the characteristics of the people who participate in these activities.

For the purpose of making the theory class more engaging for everyone, the lecturer asked the students questions about their own experiences related to what would be taught. These questions were answered as part of the active learning process. In this way, students were encouraged to participate in the process and recognise that design is not a new concept but is based on our everyday experiences (prior experience). Using this method, the lecturer can learn more about the students' backgrounds based on the topic. Depending on the design section presented, there were different discussions to fit what they knew and what was expected when designing (how the design should appear). At the end of the presentation, the students were allowed to ask questions and offer comments regarding what was taught in the classroom.

During student-led practical classes, students were asked to apply the theory taught to their design in the form of an assignment. Students who volunteered as participants in this study had to reflect on the theory they learned from the theory classes after receiving feedback on their assignments.

3.4.2 Participants' biographical details

This section presents the profiles of the participants. The research was conducted at a university of technology in South Africa in a Graphic Design II 2020 class. The class consisted of three groups, in which the first group had 76 students (*15 repeaters*) who were enrolled for a Diploma in Information Technology and were taking the module in their second year of study. The second group consisted of 21 extended program students (*one repeater*) who registered for the module in their third year of study, since they started with extended program modules in their first year. The final group comprised six third-year students (*six repeaters*) who were registered for the phased-out National Diploma in Information Technology and were doing the module as a year module which comprised the first and second semesters of the Graphic Design II modules. In total, there were 103 students (*22 repeaters*)

registered for the module, whose ages ranged from 19 to 34 years, with 67 males and 36 females.

All students who completed the assignment were invited to participate in the study, and since it was voluntary, only 66 students (64%) participated in this stage. This was done through the submission of written interviews. The group consisted of 47 participants aged 19 to 24, 10 participants aged 25 to 29, and four participants aged 30 to 34. There were 28 female participants and 38 male participants. Table 3.2 shows the age and gender breakdown of the 66 participants.

Table 3.2: Participants' biography summary

Ages	Gender	Participants	Repeaters	Total
19 - 22	F	<i>ptp04, ptp20, ptp22, ptp27, ptp29, ptp36, ptp39, ptp49, ptp50, ptp58, ptp62, ptp64</i>	<i>ptp21, ptp47, ptp56, ptp65</i>	16
	M	<i>ptp06, ptp13, ptp26, ptp32, ptp35, ptp51, ptp54, ptp57, ptp61, ptp63, ptp66</i>	<i>ptp03</i>	12
23 - 26	F	<i>ptp08, ptp12, ptp15, ptp23, ptp25, ptp34, ptp37, ptp46, ptp52, ptp55, ptp59,</i>	<i>ptp17</i>	12
	M	<i>ptp01, ptp02, ptp05, ptp10, ptp16, ptp18, ptp24, ptp28, ptp31, ptp33, ptp40, ptp41, ptp44, ptp45, ptp48</i>	<i>ptp07, ptp38</i>	17
27 – 31	F	<i>none</i>	<i>ptp19</i>	1
	M	<i>ptp04, ptp30</i>	<i>ptp09, ptp11, ptp53</i>	5
32 – 35	F	<i>none</i>	<i>none</i>	0
	M	<i>ptp42, ptp43, ptp60</i>	<i>none</i>	3
Total				66

The data displayed in Table 3.2 indicates that 12 participants were repeating the module, but this is not an indication of prior knowledge, given that some students terminate the module even before attending the classes. It is not clear from the data which students terminated the module without attending the classes or who attended a few classes and failed, as the university system treats them all as repeating the module.

3.4.3 Data collection

Written interviews were given to students to gain a better understanding of their perceptions of how theoretical class activities relate to practical activities. A few broad questions were asked to determine whether the students utilised the theory when completing their practical projects.

As part of the assignment, students had to select two devices to look at the different components of a given user interface and identify negative and positive properties. The devices were chosen based on which device they used most often and which device they used least often. Students were given a rubric to assist them in understanding how their work would be assessed and to guide them on what they were required to do. The assignment was posted and submitted to a blackboard facility called eThuto, which is a learning management system (LMS) used at the University of Technology for Online Teaching and Learning.

The participating students were given written interviews to complete after receiving feedback on their assignments. An announcement was made on eThuto, requesting students to participate. A link was provided to access the written online interviews. The responses were typed directly on the written online interview. Due to the lockdown protocols imposed due to COVID-19, no face-to-face lessons were held after the first two theory sessions; instead, classes were presented online using the Microsoft Teams. Written interviews entailed open-ended questions which did not restrict the students regarding the length of their answers. The written interviews commenced on 22 July 2020. The last student to participate completed the written interview on the 12th day (02 August 2020) after it was released. The first semester ended in August because of the lockdown and students waited for the university to provide them with mobile data for online learning.

QuestionPro online survey software was used to collect data. Data were collected from the participants to provide an overview of the problematic situation. The participants are known to the researcher, but their identities are not mentioned by name in the study, as indicated in the ethics section in Chapter 2.

3.4.4 Data analysis

The data analysis method selected was a conventional content analysis, where codes were derived from the data collected from the participants. The conventional content analysis method aims to describe the phenomenon (Hsieh & Shannon, 2005) as described in Section 2.4.6. Table 3.3 displays the process followed.

Table 3.3: Content analysis process adapted from Zhang and Wildemuth (2009) applied to this investigation

Process of content analysis	Significance of the process
1. Preparing the data	The data collected was in a written form from the written interviews and was prepared to be used on Atlas.ti software in Section 3.4.4.1.
2. Defining the unit of analysis	The selected unit of analysis is the sentence or words to classify the content of each participant's response per each question in Section 3.4.4.2.
3. Developing initial codes and categories	In this study, the categories are derived from the data collected from the participants as outlined in Section 3.4.4.3.
4. Testing the initial codes and categories on a selection of data	A selection of text from three participants were coded and categorised as outlined in Section 3.4.4.4.
5. Coding and categorising of all the text	The coding process was applied to the entire text as outlined in Section 3.4.4.5.

6. Assessing consistency	The consistency of codes was reviewed as new codes emerged and were applied to the entire text as outlined in Section 3.4.4.6.
7. Drawing conclusions	Categories were identified to draw conclusions from the data by presenting the reconstructions of meanings derived from the data as outlined in Section 3.6.
8. Reporting methods and findings	The research methods and findings are reported in Chapters 2, 3, 6, 7, and 8.

3.4.4.1 Preparing the data

For qualitative content analysis, the initial stage involves preparing the data in written form (Zhang & Wildemuth, 2009). All data collected were ready to be used for analysis. Identifiable information about the participants was deleted and replaced with a participant identifier (e.g., ptp01 and ptp02). The collected data were downloaded from the QuestionPro site for use in the Atlas.ti software application. After preparing the data, it was necessary to determine the appropriate unit of analysis.

3.4.4.2 Defining the unit of analysis

The second step in qualitative content analysis is to define the unit of analysis. The questions asked in the written interviews were the same for all the participants. Each participant's full response to a specific question was used as the unit of analysis. An in-depth analysis of each response was conducted, followed by extensive interpretation of the data. Categories and coding schemes were developed by defining the units of analysis. To obtain a better perspective on the answers provided, the fundamental principle of the hermeneutic cycle described by Klein and Myers (1999) was applied in this study. The individual parts of the responses were compared to the complete responses from the written interviews to gain a better understanding. The responses of a specific participant to a specific question were compared with the responses of other participants to better understand the specific participant's perspective.

3.4.4.3 Developing categories and coding schemes

The next step in qualitative content analysis is to develop categories and coding schemes. A system can be developed to help make sense of the data by organising the codes according to different categories after all codes have been saturated (Maree, 2007). According to Saldaña (2021:9), “to codify is to arrange things in a systematic order, to make something part of a system or classification, to categorize”. Codifying occurs when codes are applied to qualitative data and reused (Saldaña, 2021). Most responses are examined in Section 3.7.2.5, along with the assigned codes. The codes provided a short description of the data. The conventional approach was employed in this study, where codes emerge from the collected data and categories are then formed by grouping the codes that contribute towards the same context or meaning.

Categories were formed to give meaning to the codes. In order to diagnose the situation correctly, the questions were based on prior knowledge, lessons learned, theory application, and reflection on what could be improved based on the feedback the participants received for their assignment. The categories that emerged from the collected data were *feedback reaction*, *prior knowledge*, *theory-learned*, *application of theory*, *improved answering approach*, and *preparation*.

A sample of the *improved answering approach* category is presented in Figure 3.1 to demonstrate the codes that have been grouped into one category.

	Name	Groups
☐	◇ Answering technique	[Improved approach]
☐	◇ Manage time effectively	[Improved approach]
☐	◇ Improve marks	[Improved approach]

Figure 3.1: The improved answering approach category extracted from Atlas.ti

To conclude the development of the categories and coding schemes, a sample of data needs to be tested using the coding scheme.

3.4.4.4 Testing the coding scheme on a sample

Conventional content analysis was used, as presented in Section 2.4.6, and the codes were derived from the data received from the participants. According to Zhang

and Wildemuth (2009), testing category definitions on a sample of data is the most effective method for ensuring clarity and consistency. In this study, the approach was to analyse each participant's response per question.

As a means to test the conventional coding method on a text sample, three participants' responses were coded. A code sample for question 6 is displayed in code extract 3.1, to establish what the students would do differently if they had to complete the assignment again.

Code extract 3.1: If you could do this assignment over, what would you do differently?

Response	Code
<i>ptp11: Find more information and understand fully what I am doing.</i>	Do research Focus on understanding process
<i>ptp23: I would read the questions more carefully and not just go through the theory chapter but read with understanding.</i>	Understand the question
<i>Ptp39: I will ask the lecturer questions related in order to understand more.</i>	Request clarification

The sample of text coded for *ptp11* provided the researcher with the insight that the participant needed to conduct research to find more information about the assignment and to understand what he was doing when answering the questions. There were two codes assigned to the text: *Do research* and *focus on understanding actions*. Upon testing the coding scheme on a sample, all texts were coded.

3.4.4.5 Coding all the text

The fifth step of the qualitative content analysis is to code the entire text. After achieving acceptable consistency, the coding approach was applied to the overall text (Zhang & Wildemuth, 2009). The entire text was coded by assigning a code to each data item using the Atlas.ti software. When coding all text, each data item is examined to determine the code that describes it appropriately. New codes were added when required. Patterns are identified in the codes to form categories that

contribute to the same concept. The Atlas.ti headers are *Name* that specifies the codes, *Grounded* is the number of quotes, and *Groups* are the names of the categories. In Figure 3.1, all the names for the codes are displayed in alphabetical order according to the categories that emerged. The grounded count represents the total number of quotes for each code (Frieze, 2019).

Name		Grounded	Groups
◇ Invalid theory application response	○	2	[Application of theory]
◇ Theory application	○ ██████████	48	[Application of theory]
◇ No theory application	○ █	9	[Application of theory]
◇ Tried theory application	○ █	7	[Application of theory]
◇ Inspect feedback	○	1	[Examine feedback]
◇ Scrutinize memorandum	○	1	[Examine feedback]
◇ Invalid feedback response	○ █	3	[Feedback reaction]
◇ Agitated	○	1	[Feedback reaction]
◇ Worried	○	1	[Feedback reaction]
◇ Satisfied	○	1	[Feedback reaction]
◇ Surprised	○	1	[Feedback reaction]
◇ Neutral	○ █	12	[Feedback reaction]
◇ Happy	○ █	7	[Feedback reaction]
◇ Relieved	○ █	11	[Feedback reaction]
◇ Dissatisfied	○ ██████████	28	[Feedback reaction]
◇ Not satisfied	○	1	[Feedback reaction]
◇ Focus on understanding process	○	1	[Improved answering approach]
◇ Answering technique	○ ██████████	27	[Improved answering approach]
◇ Improve marks	○ █	3	[Improved answering approach]
◇ Manage time effectively	○ █	6	[Improved answering approach]
◇ Research less	○	1	[No approach/Invalid response]
◇ Yes/No/Definitely response	○ █	6	[No approach/Invalid response]
◇ No idea	○ █	5	[No approach/Invalid response]
◇ Change nothing	○	1	[No approach/Invalid response]
◇ Study method	○ █	8	[Preparation]
◇ Request clarification	○ █	4	[Preparation]
◇ Understand the question	○ █	9	[Preparation]
◇ Do research	○ █	6	[Preparation]

Name		Grounded	Groups
◊ Repeating module	○	1	[Prior knowledge]
◊ Prior HCI knowledge	○	1	[Prior knowledge]
◊ Empirical knowledge	○	2	[Prior knowledge]
◊ Researched knowledge	○	3	[Prior knowledge]
◊ Unspecified knowledge	○ █████	26	[Prior knowledge]
◊ No prior knowledge	○ █████	20	[Prior knowledge]
◊ Module introduction	○ █████	12	[Prior knowledge]
◊ Invalid knowledge response	○	1	[Prior knowledge]
◊ Theory eased practical	○	1	[Theory learned]
◊ Assignment related content	○ █████	46	[Theory learned]
◊ Conduct research	○	2	[Theory learned]
◊ Invalid learning response	○ █████	9	[Theory learned]
◊ Negative response	○	1	[Theory learned]
◊ Importance of theory	○ █████	5	[Theory learned]
◊ To understand practical	○	1	[Theory learned]
◊ Learning not specified	○	1	[Theory learned]
◊ Present verbally	○	1	[Unhappy with marking]
◊ Request remarking	○	2	[Unhappy with marking]

Figure 3.2: Codes extracted from Atlas.ti

When all the text had been coded, consistency in the coding had to be evaluated to prevent any inconsistencies in the next section.

3.4.4.6 Assessing consistency

According to Zhang and Wildemuth (2009), coding consistency must be reviewed when the coding of the entire body of the text is completed. The researcher was not satisfied that the codes were consistent throughout the entire body of the text, as the text was coded for each response per participant. Codes were checked for inconsistencies by going through the data twice manually. The codes were revised, and some codes were renamed as meaningful codes, as indicated in Code extract 3.2.

Code extract 3.2: Revised codes.

Response	Initial coding	Revised code
<i>ptp25: No, I didn't have any knowledge it was</i>	None	No prior knowledge

<i>my first time knowing the information</i>		
<i>ptp45: Yes, I once did human computer interaction subject at the college I come from. I could relate when doing the assignment.</i>	HCI knowledge	Prior HCI knowledge
<i>ptp61: I learned about designing interactive systems which is something I know before, but the assignment made it broader for me and I learned the purpose of interactive systems</i>	Assignment related content	Learned module content

Once all coding was complete, the codes were reviewed to ensure that all texts were coded by going through the data once again. The researcher realised that going through the data twice was insufficient. Following the assessment of consistency in codes, conclusions were drawn from the data collected.

3.5 Results and discussion

In the 7th step, all categories identified are synthesised along with their properties. The researcher made sense of the data based on the categories formed in the previous section.

Each category was reviewed to extract meaning from the data. The purpose of this stage is to diagnose the perceived problems in the HCI classes. This is being done to assist in making informed decisions about the measures that will need to be put in place. The results will guide the researcher in identifying the appropriate theory to address the identified situation.

Based on the data, six categories were identified to assist with the aim of the research: *feedback reaction*, *prior knowledge*, *theory learned*, *theory to practice application*, *preparation*, and *improved answering approach*.

3.5.1 Feedback reaction category

The first and second questions were designed to determine how the students felt about the feedback they received about their assignments. In the first question, participants were asked to select an emotion that described how they felt when they received feedback. In the second question, they were asked to describe how they

felt when they received feedback. Participants were asked how they felt when they received their assignments. The following options were provided as part of the interpretive interview: *celebrating, excited, happy, relieved, neutral, disappointed, crying, angry, and furious*. The questions yielded quantitative data which are presented in Table 3.4. Of the 66 students, 23 (34.9 %) indicated that they felt neutral about the feedback they received regarding their assignment, and 19 (28.8 %) were disappointed with the feedback they received.

Table 3.4: Student's reaction to the feedback

Answer	Percentage (%)	Count(N)
Celebrating	0%	0
Excited	6.1%	4
Happy	6.1%	4
Relieved	18.2%	12
Neutral	34.9%	23
Disappointed	28.8%	19
Crying	1.5%	1
Angry	4.6%	3
Furious	0%	0
Total	100%	66

To understand the students' reactions, the next question required them to describe their initial responses to feedback. Reactions to the feedback category were formed based on the coded text. Different responses were provided and coded accordingly, as shown in Table 3.5.

Table 3.5: Summary of Feedback reaction category codes

Code No.	Code	Frequency
1.	Disappointed	28
2.	Neutral	12
3.	Relieved	11
4.	Happy	7
5.	Invalid feedback response	3
6.	Not satisfied	1
7.	Surprised	1
8.	Satisfied	1
9.	Worried	1
10.	Agitated	1

The feedback reaction category for HCI students can be summarised as follows:

- Some participants felt neutral about their grades because they did not understand what the assignment was about. *“Neutral because I didn’t fully understand the assignment and how to do it, however, I did answer as best as I could, so when I saw the marks, I wasn’t disappointed but had hoped to score more than I did” (ptp12).*
- Participants were happy when they received grades they did not expect and when they had passed. *“I was happy because I wasn’t expecting to get such marks but at least I have passed” (ptp19).*
- Although the students needed to understand what the task was all about before they started to work on the assignment, the theory notes assisted in completing the task. *“I felt like I needed clarity on the topic but with the notes, I managed to work around the assignment” (ptp40).*
- As a result of receiving feedback, students felt reassured about how their work was assessed and were glad when they had passed despite not comprehending the task they were assigned to perform. *“I somehow felt a weight off my*

shoulders that I passed but was however satisfied with my marks. I did not have a clear understanding of what the assignment required” (ptp48).

- If a participant considers that he or she performed better than their marks show, they may be dissatisfied with their grades. *“I felt like I did a much better job than what the results reflect there” (ptp60).*

The aim of questions 1 and 2 was to capture participants’ first impressions after receiving feedback about the assignment.

The questions were asked in such a way that they would evoke the participants’ emotions after receiving the feedback so that they could reflect on that moment and capture what they felt. Participants who were less pleased with their grades were more likely to respond to the questionnaire than those who performed well. The researcher improved her understanding by observing where awarded grades were lower or higher than anticipated. When the grades were lower than anticipated, the response was “disappointed” (29%), and when they were higher than what was expected, the response was “relieved” (18%), “happy” (6%), or “excited” (6%).

The lesson learned from this question is that the feedback provided to students should be more detailed, in addition to the rubric provided. The main aim of a rubric is to provide more information about where students received lower marks so that they can examine and understand how they were awarded such marks. It also assists students in performing better in future assignments by helping them avoid repeating the same mistakes.

3.5.2 Prior knowledge category

In Question 3, the participants were asked whether they had any prior knowledge and skills in relation to the assignment. The purpose of asking about prior knowledge was to establish whether participants had previous knowledge that assisted them in completing the assignment. Prior knowledge in this context is the knowledge possessed before the lecture was presented on the topic. Codes were created based on the answers provided. The codes were then grouped into the “*prior knowledge*” category, and a summary is provided in Table 3.6.

Table 3.6: Summary of Prior knowledge category codes

Code No.	Code	Frequency
1.	Unspecified knowledge	26
2.	No prior knowledge	20
3.	Module introduction knowledge	16
4.	Researched knowledge	3
5.	Empirical knowledge	2
6.	Invalid knowledge response	1
7.	Prior HCI knowledge	1
8.	Repeating module	1

The prior knowledge category for participants is summarised as follows:

- Participants who had prior knowledge indicated that they had acquired knowledge from the chapters that they had studied to complete the assignment. *“Nothing besides reading the textbook and slides” (ptp22); “Yes, because I studied very well” (ptp35); “Yes, I had the knowledge I learned from our previous theory classes” (ptp58).*
- Some participants admitted that they were encountering the content for the first time, indicating that they did not have prior knowledge of the topic. *“No, I didn't have any knowledge it was my first time knowing the information” (ptp25).*
- Some participants indicated that they were able to relate to the content of the assignment which suggested prior knowledge in place. *“Yes. The assignment was based on everyday appliances” (ptp38).*
- A participant who learnt HCI content at a previous institution could relate to the content of the assignment, which indicates that prior knowledge was available. *“Yes, I once did human-computer interaction subject at the college I come from. I could relate when doing the assignment” (ptp45).*
- Prior knowledge of the content of the module was also obtained by repeating the module. *“Yes, I am repeating the subject” (ptp53).*

According to Zeichner and Liston (2013), it is possible to criticise, examine, and improve a task by drawing on previous experiences. The question was designed to gain information about the experiences that the student possessed. From the researcher's perspective, participants were unable to understand the context of the questions. The question was also not specific because the participants thought that the work done in class or chapters, they studied for the assignment constituted prior knowledge. The knowledge that they had before completing the assignment was the knowledge gained in class or knowledge possessed by those who self-studied to complete the assignment. Only one student had prior knowledge gained from the college he attended before enrolling at the university, where HCI content was part of the instruction. Another student repeated the module and wrote about that experience as prior knowledge which was relevant to the context of the question.

Most participants (39%) indicated that they had prior knowledge but did not specify the type of knowledge they had. Their answers were very brief, and were therefore inadequate to extract the type of prior knowledge they possessed, as they only responded by stating "yes".

3.5.3 Theory-learned category

Question 4 aimed to understand what students learned from the theory related to the assignment they completed. Participants were asked what they had learned from the theory chapter in relation to the assignment. The purpose was to establish whether the students were aware that the practical assignment was based on theoretical content. Some participants were able to use the theory while completing the assignment. A summary of theory-learned category is presented in Table 3.7.

Table 3.7: Summary of theory-learned category codes

Code No.	Code	Frequency
1.	Assignment related content	46
2.	Invalid learning response	9
3.	Importance of theory	5
4.	Conduct research	2
5.	Theory eased practical	1
6.	Negative response	1
7.	To understand practical	1
8.	Learning not specified	1

The theory-learned category for HCI students can be summarised as follows:

- Some participants perceived the theory as the foundation of practice. *“Interaction design, I think the theory prepared us for the assignment”* (ptp01).
- Some participants realised that research had to be conducted to understand what needed to be accomplished. *“Researching is needed to be familiar and knowledgeable about almost everything”* (ptp12).
- Some participants realised that what they did in the theoretical part of the module could be applied to real-life situations. *“I did learn about how rich picture is important to us, and it doesn't work only for IT but life in general”* (ptp20); *“I've learned that what we do in theory chapter can be done in a real-life situation”* (ptp57).
- Some participants recognised that the theory prepared them to understand the practical components of the module. *“I understood all about interfaces and their differences”* (ptp25).
- By using theory, participants were able to analyse whether the design was good or bad for human use. *“How to learn and analyse user interface of any product, the good and bad of the product design”* (ptp42).

- The participants appreciated that the theory prepared them to compare different interfaces. *“How to compare different interfaces regardless of their job. Basics on what to look at before designing a product” (ptp45).*
- Not all the participants saw the relevance of the theory to the module. *“To be honest I don't know. I was doing the task in order to finish it according to the given instructions” (ptp66).*

The lessons learned from this category highlight an important aspect of linking theory to practice in HCI classes. This question also draws attention to the importance of learning theory in HCI classes, which is intended to provide participants with the necessary knowledge that they can use when dealing with the practical component of the module. This knowledge can also be applied to other areas of their work or study.

3.5.4 Application of theory category

Question 5 was designed as a follow-up to Question 4 to determine whether the students applied the theory they learned when completing the practical assignment. They were asked whether they were able to practically apply the theory chapter in the assignment. The summary of the coded data is presented in Table 3.8

Table 3.8: Summary of Application of theory category codes

Code No.	Code	Frequency
1.	Theory application	48
2.	No theory application	9
3.	Tried theory application	7
4.	Invalid theory application response	2

Some of the answers provided regarding the application of theory to practice are as follows:

- Some participants realised the consequences of not applying theory to their practical work, which significantly affected their grades. *“Not really, otherwise, I*

would've got the marks I desired, but I wrote the assignment to the best of my ability” (ptp01).

- Some participants understood that the theoretical component of the module is the foundation of what they do, which makes it easy to understand the practice. *“Yes, it was the foundation of knowledge, everything else was adding or making it more understandable” (ptp23).*
- Some participants acknowledged that the theory component helped them to complete the practical task. *“Yes, I went through the chapters before I attempted the assignment and during the assignment” (ptp58).*
- The relationship between theory and practice could be perceived even though they did not fully understand the requirements. *“Yes, I could, even though somewhere I couldn't fully understand what was required. However, there was a relation” (ptp45).*
- Some participants also understood that if they did not use the theory in their practical work, the practical part became more challenging. *“No, I was not, I did try my best on doing the assignment but some of the things were difficult to even understand” (ptp51).*

This question highlights the importance of assisting HCI participants in understanding the importance of integrating theory when completing HCI practical assignments. Emphasising the implementation of theory in practice during theory classes and asking students to give real-life examples of how they can use the theory may also assist in making them aware that the theory is not limited to class-related activities.

The results indicated a gap between theory and its application to the practical part of the module, as most participants did not indicate how they applied theory in their work. One participant indicated that the grades would have been higher if the theory had been applied. This reflection from a participant indicated that the participant was aware of the theory that relates to the assignment and the relevance of applying that theory to achieve better results in the HCI assignment they completed. This lesson was intended to be extended beyond the classroom and applied to the workplace when employed.

3.5.5 Improved answering approach category

Question 6 focused on lessons learned to determine what the students could do differently from what they had done in the assignment if given an opportunity to redo it. The question was reflective, as it required them to look back and ponder their actions and devise a plan that could be applied when faced with a similar situation. Two categories emerged from this question: *improved answering approach* and *preparation*. The participants provided different planned actions, some of which are presented below. Most students considered performing the assignment again as a plan to improve their performance. A summary of the coded data is provided in Table 3.9.

Table 3.9: Summary of Improved answering approach codes

Code No.	Code	Frequency
1.	Answering technique	27
2.	Manage time effectively	6
3.	Improve marks	3
4.	Focus on understanding process	1

The improved answering approach category for participants can be summarised as follows:

- Effective management of time is important for HCI students to perform well during assessments. *“I will finish it on time because now I have experience and I will get total marks” (ptp30).*
- Some participants realised that going through the theory chapter for the sake of reading, without understanding, does not benefit them; they should be able to construct meaning from what they are reading. *“I would read the questions more carefully and not just go through the theory chapter but read with understanding” (ptp23).*

- Some participants were aware that, to execute the task correctly, it was important to follow the instructions and understand what the question required. *“I will make sure that I follow all the instructions and understand everything that is being asked from me” (ptp46).*

In an effort to understand what participants would do differently in the assignment, different strategies were mentioned. Participants were able to think about the strategy they could employ to improve their grades. Research on the topic, redoing the assignment, understanding the question, taking a different approach, and following the instructions were the responses that stood out when it came to this category. These responses indicated that the participants had a realistic and achievable plan that they could follow to improve their grades. Participants viewed the assignment as beneficial for their learning growth. Without introducing the concept of RP, the responses revealed that RP could assist participants in performing better assessments. This would also enable them to engage in a deeper level of learning to enhance their personal and professional growth. An important stage in developing RP is evaluating what has been done and what needs to be done (Taole, 2015).

3.5.6 Preparation category

In this category, students were asked what they would do differently if they could redo the assignment. The second category that emerged from Question 6 was *preparation*, which focused on how participants prepared for their assignments. A summary of the coded data is shown in Table 3.10.

Table 3.10: Summary of Preparation category codes

Code No.	Code	Frequency
1.	Understand the question	9
2.	Study method	8
3.	Do research	6
4.	Request clarification	4

Participants used different methods, as indicated below.

- Participants were aware that they could use the opportunity to ask the lecturer questions that they did not understand to gain more clarity on what was required. *"I'd ask the lecturer questions related in order to understand more".* (ptp39).
- Participants were conscious of the fact that they should be thorough in the way they approached the questions. *"I would be extra careful as to how I answer the questions, maybe I got too excited when I saw the questions and thought the answer that I gave was the correct one"* (ptp56).
- Participants realised that they should read the question carefully before giving a response, so that they could understand or grasp what was expected. *"I'd read the questions to understand so that I can give understandable answers"* (ptp25).
- Participants perceived the benefit of conducting research on the topic to gain more knowledge. *"I would try and broaden my research so that I have more detailed answers"* (ptp48).
- An observation here is that there was an understanding that to be successful in practical assessments, students needed to first learn the theory. *"I would definitely go and check my slides and prepare well than the risk I took with this one"* (ptp54).
- Participants realised that not understanding what they should be doing had an impact on their grades *"Research more and answer the questions differently. Maybe I got low marks due to lack of understanding about the requirements of the assignment"* (ptp65).

Lessons learned from this category indicated that the students were able to recognise the resources and opportunities they could use as part of their preparation. The purpose of the preparation phase was to identify areas that students did not understand properly. As a result, students would have confidence in what to do when they were completing the assignment.

The next section presents reflections on this investigation.

3.6 Reflections on the diagnosis investigation

In preparation for subsequent AR iterations, it is necessary to reflect on what was learned from the diagnostic investigation reported in this chapter. Participants' perceptions of the perceived problematic situation were used to understand and bridge the theory-practice gap. Reflecting on participants' opinions as they received feedback from their practical assignments in written interviews provided guidance to the subsequent AR phases.

3.6.1 Reflections on reaction to the feedback category

Obtaining feedback for assignments can evoke unexpected emotions in students. Common reactions when students received positive feedback were: celebrating, excited, happy, or relieved. On the other hand, when feedback was negative, the students felt disappointed, angry, furious, or even tearful. Students who were not sure how they performed felt relieved when they realised that they had passed. The participants were given the opportunity to reflect on their feedback. This gave them the chance to look back at their responses and make sense of them. The negative feedback or low grades for the assignment were not an indication of their final grades at the end of the semester, but an indication of how they performed for that particular assignment. This approach is particularly important when students receive feedback so that they can reflect on their actions and seek ways in which they can improve. Therefore, it is essential to incorporate a form of self-reflection into learning.

3.6.2 Reflections on prior knowledge category

Since the participants did not have prior knowledge about HCI, it was important to expose the students to HCI knowledge and demonstrate its importance so that they could consider it necessary to apply it in other areas, such as programming and database modules, and later use it in the workplace.

The lecturer should be explicit when asking about the knowledge they have before beginning a new lesson so that students can have a clear understanding of what is meant by prior knowledge. Another point for consideration is that since the participants viewed what they had learned in class as prior knowledge, face-to-face lectures or online class recordings must also be available on the LMS for them to go

through the lectures later and for those who missed the class. These students should be introduced to as much HCI content as possible, because they are involved in graphic design. The researcher believes that this exposure will familiarise students with HCI in other areas, whenever it is needed.

3.6.3 Reflections on theory-learned category

The purpose of Question 4 was to establish whether the participants learned anything from the theoretical content that they could relate to the practical assignment. Drawing from the collected data, most participants were able to identify one or two aspects that they had learned related to the assignment content. For students without prior knowledge to participate in the introduction session, a scenario related to the topic can be introduced to determine whether they can relate to the topic.

The practice of studying HCI theory just to pass should be discouraged. Different strategies that will assist in bridging the theory-practice gap in HCI classes must be explored and implemented where appropriate. The aim is for students to understand the importance of integrating knowledge learned from theory into practical settings.

Reflective practice (RP), as presented in the previous chapter and discussed in the next chapter, is a strategy that can be used to bridge the theory-practice gap by assisting students in thinking about what they are doing. This will help students to understand their actions and find ways to improve them. The next section presents a follow-up question from this section intending to determine whether the theory was applied during the process of completing the assignment.

As educators point out, RP is an evolution that recognises the need for students to behave and think professionally throughout their academic careers, combining theory and practice from the beginning (Helyer, 2015). Being able to put theory into practice includes developing practical skills using the HCI theory. Therefore, a reflective practitioner is someone whose practice is guided and informed by experience and theory (Esterhuizen & Howatson-Jones, 2019). Hence, the study aims to develop students as reflective practitioners so that they can utilise the theory they have learned in practice. Kolb (2014) argues that the process of learning throughout one's life occurs when theory and experience are connected. Classes

need to be structured in such a way that theory is presented before practical so that students can acquire background knowledge and have a better perspective on what they need to do in practice.

3.6.4 Reflections on the application of theory category

Developing students as reflective practitioners can assist them in understanding that HCI is a practical module and make them aware of the important role played by theory. In turn, they can reflect on how they can apply related theory to the practical components of HCI. The presentation of the theory in the classroom should be relevant to the practical components of the module. Real-life situations should be used during lectures to emphasise the application of this theory.

The second graduate attributes document prescribed by CUT also highlights the ability to apply the theory to different situations, as mentioned in its definition in Table 3.11.

Table 3.11: Graduate attributes prescribed by CUT (CUT, 2021:7)

CUT Graduate Attributes	Official Definition	Practical Definitions
2. Innovation and problem-solving.	Be innovative, think creatively and critically, and apply a range of strategies to solve/find solutions for real-world problems. Demonstrate the ability to apply the theoretical knowledge that will lead to the development of new ideas, methods, techniques, practices, products, and services in a variety of contexts (technology, commerce, social systems).	Promoting the iUSE model (investigate, understand, solutions and evaluate)

The application of the theory category supports the attributes that the university prescribes to students, which is to apply theoretical knowledge in different situations.

Practising RP can help bridge the gap between theory and practice. The RP process also supports continuous learning, which can assist students in accomplishing the graduate attributes mentioned above. The next section presents the actions planned by the participants to correct their mistakes or improve their academic performance.

3.6.5 Reflections on preparation and planned action category

Based on these categories, one participant indicated that procrastination was problematic. A delay in commencing the work can cause a student to do an assignment under pressure due to a close deadline, which can also cause them to not understand the question properly.

Some participants used memorandums from previous assessments to prepare for the main assessments. Students might be studying the style of the questions asked or the way to answer certain types of questions or to compare them with their answers.

One participant indicated that she wanted to examine the memorandum. This may be interpreted in two ways: the student might want to compare their answers with those provided on the memorandum or they want to study the memorandum and not study their notes. Either way, the students should be provided with proper feedback after the assessment so that they can understand their mistakes and correct them.

Another participant mentioned, *‘following the instructions’*, which is also deemed crucial by the university during assessments. This information was also supplied in the learner guide (CUT, 2021:8). The students were asked to abide by the following instructions when answering any assessment:

- *“Read the question carefully; make sure you know what is being asked.*
- *Then, stop and think.*
- *Write your answers systematically and as neatly as possible.*
- *Show all your calculations at all times; that is, how you arrived at the solution.*
- *Make sure that you manage your time effectively; in other words, you do not spend more time on one question than is available. Work fast and accurately!*
- *Work through tutorials, previous tests, and examination papers, in order to get used to the style and standard of the papers.”*

Students should be reminded about this crucial information at the beginning of the semester and when they are about to write the assessments, to assist them in applying the strategies accordingly and reflecting on them. It is important for students to reflect on their practices in order to integrate instruction into their learning. The instructions provided were reflective in nature; therefore, learning can be enhanced through RP to assist students in developing their skills. Reflecting on their actions will also assist students not to make the same mistakes. Thinking about what to do will encourage students to consider different approaches to achieve their objectives. Students who employ this structured approach to problem solving can develop into reflective practitioners.

A summary of the findings in the form of guidelines is presented in Table 3.12. Code GSD was used to represent the guidelines from the students' data.

Table 3.12: Guidelines from students' data (GSD)

Guideline code	Guideline	Data	Reference
GSD1: Question-answer session	Establish a platform that encourages students to ask questions about the parts of the work they find challenging.	Ask the lecturer questions about the parts of the work that they do not understand.	Section 3.5.6
GSD2: Understand the question	Request students to make sure they understand the question first before attempting to answer it.	Understand the question first before attempting to answer it.	Section 3.5.6
GSD3: Research	Ask students to seek more information about the topic to gain more knowledge.	Conduct research to gain more knowledge about the topic.	Section 3.5.3
GSD4: Theory-practice gap.	Teach theoretical content first for students to understand the practical component of the module.	Learn theory first to understand the practical component of the module.	Section 3.5.4

Guideline code	Guideline	Data	Reference
GSD5: Students bridging the theory-practice gap.	Request students to learn theory first to understand the practical component of the module.		
GSD6: Time management	Assist students with strategies on how to manage time effectively.	Manage time effectively.	Section 3.5.5
GSD7: Prior knowledge	Incorporate work that will give students a chance to use prior knowledge.	Use a prior knowledge of the work that is current and relevant in their minds.	Section 3.5.2

The next section presents guidelines from diagnosing the problem.

3.7 Guidelines from diagnosing the problem

The guidelines identified from this chapter are presented in Table 3.13. Code GDP is used to represent guidelines from diagnosing the problem.

Table 3.13: Guidelines from diagnosing the problem

Guideline code	Guideline	Reference
GDP1: Question-answer session	Establish a platform that encourages students to ask questions about the parts of the work they find challenging.	GSD1
GDP2: Understand the question	Request students to make sure they understand the question first before attempting to answer it.	GSD2
GDP3: Research	Ask students to seek more information about the topic to gain more knowledge.	GSD3
GDP4: Theory-practice gap	Teach theoretical content first for students to understand the practical component of the module.	GSD4

Guideline code	Guideline	Reference
GDP5: Students bridging theory-practice gap	Request students to learn theory first to understand the practical component of the module.	GSD5
GDP6: Time management	Assist students with strategies on how to manage time effectively.	GSD5
GDP7: Prior knowledge	Incorporate work that will give students a chance to use prior knowledge.	GSD6
GDP8: Attending classes	Recommend to students to attend all scheduled theory and practical classes.	GLO1
GDP9: Preparing for lecture	Ask students to prepare thoroughly for the lecture by reading the relevant section before attending.	GLO2
GDP10: Studying after lecture	Request students to review the section after the lecture before the next one.	GLO3
GDP11: Completing assigned work	Advise students to complete all the assigned work.	GLO4
GDP12: Acquiring correct answers	Ask students to get accurate answers afterward and have a thorough understanding of them.	GLO5

3.8 Chapter summary

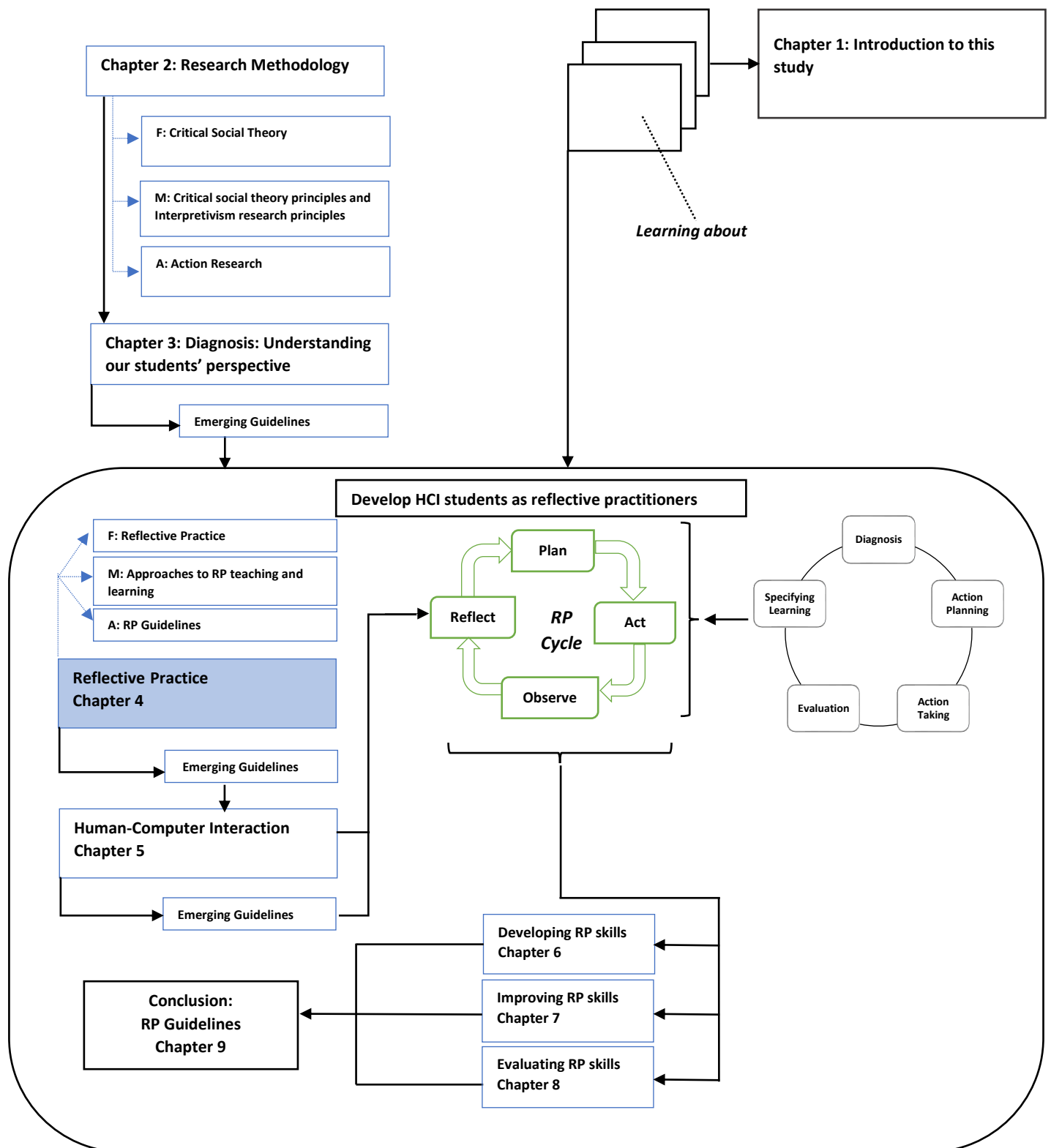
In this chapter, the first stage of the action research (AR) cycle to explore or diagnose problematic situations experienced in the HCI learning environment was presented. The diagnosis of the problem was done so as to gain some understanding of the students' experiences before selecting an appropriate theory to guide the action-taking phase. Since the researcher diagnosed the problematic situations experienced in the HCI learning environment and gained an understanding of the students' experiences, the process of developing guidelines commenced in this chapter.

Students who volunteered to participate in the study completed written interviews after receiving feedback on their assignments. The purpose was to diagnose the

current situation in HCI classes for students to reflect on how they reacted to the feedback received, prior knowledge they possess, what theory they have learned from the assignment, the perceived theory-practice gap, and the actions they plan to take to tackle similar situations in the future.

Content analysis was performed to analyse the data. Codes and categories were formed to guide the process. The conclusions drawn from the data were presented. Reflections were made for each category. The information gathered showed that some participants could not apply what they had learned in theoretical classes to their practical assignments. The findings also implied that the existing approach to teaching HCI should be modified to successfully link theory and practice. Reflective practice, as briefly discussed in the previous chapter and in the next chapter, was justified as a technique to assist in alleviating the identified problematic situation. This justification is explored further after the literature is presented in the next section. To develop practical knowledge, Schön highlighted the need to reflect on one's own experiences (Ziebart & MacDermid, 2019). Murphy and Ermeling (2016) emphasise that the use of RP facilitates the application of the theory.

In the next chapter a literature review was conducted on RP to provide context and demonstrate its relevance to the study. The literature that was reviewed assisted in developing a plan for subsequent action research cycles. The next chapter presents the RP literature to determine how it can be incorporated into this study to assist in developing students as reflective practitioners.



CHAPTER 4: REFLECTIVE PRACTICE

4.1 Introduction

The primary objective of this research is to formulate guidelines for developing Human-Computer Interaction (HCI) students as reflective practitioners. In order to accomplish this, reflective practice (RP) as an approach is employed to achieve the outcome of developing the students as reflective practitioners.

There is a common belief that there is a gap between HCI theory and actual practice (Beck & Ekbja, 2018; Remy *et al.*, 2015; Velt *et al.*, 2020). Students do not employ reflection when carrying out activities, even though it has been proven to improve their ability to learn. This study proposes that the gap between HCI theory and practice can be mitigated by employing RP. Some published studies have also shown how RP can assist to bridge that gap (Chen, 2023; De Swardt *et al.*, 2011; Hatlevik, 2012; Tlale-Mkhize & Liebenberg, 2023). The literature also indicates that to be a reflective practitioner, one must think about their work and reflect on it. According to Slade *et al.* (2019), the process of reflective thinking is explained as a way of assisting students in making connections between their knowledge and their experiences to provide them with a more thorough understanding of what they have learned during the practical application.

A literature review on RP was conducted based on the findings from the diagnosis of the problems observed in Chapter 3. Employing the principle of taking a value position espoused by Myers and Klein (2011), RP was identified as an appropriate theory to guide the intervention required to develop the students to their optimal potential. The literature review can aid in formulating the guidelines for developing the students as reflective practitioners to assist in progressing their learning.

This chapter aims to present an overview of current research and discussions on the application of RP as a framework of ideas to develop students as reflective practitioners as depicted in Figure 4.1. A study conducted by Ejlsing-Duun and Skovbjerg (2019) supported the use of RP in disciplines that involve design processes for the students to play the role of designers as part of the process. Design processes give students more opportunities to act because they visualize

and bring concepts to life in order to improve their practice. The study was a collaborative effort between the instructors and students. RP is useful to guide the methodology and the specific area of application of this study and has been used by Kovalchick and Dawson (2004) in the area of education technology.

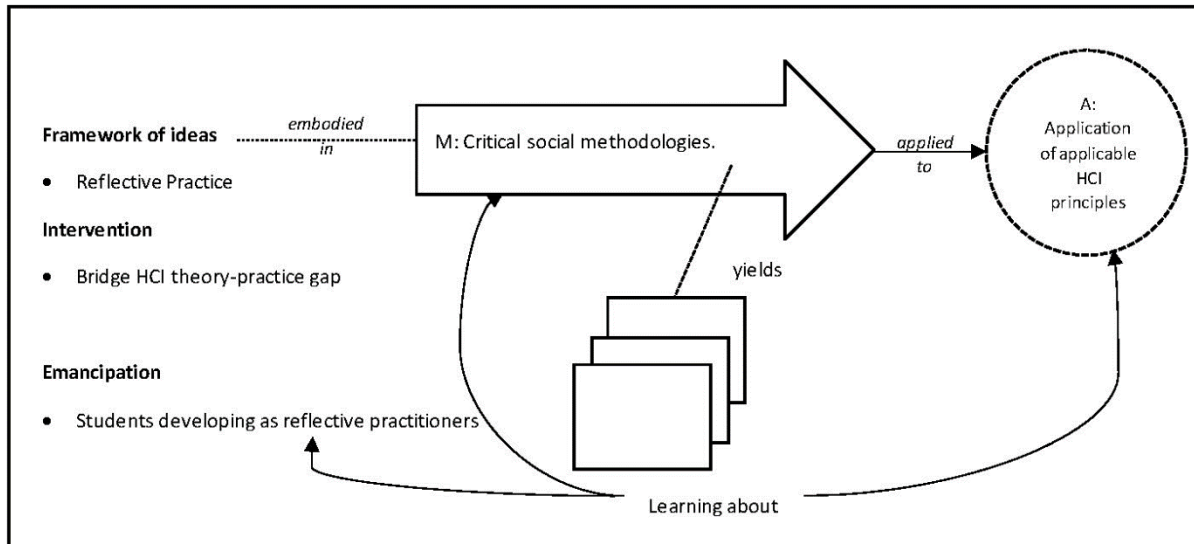


Figure 4.1: Elements of the study depicting Reflective Practice (F)

Reflective practice is a critical element of reflective learning because it allows students to evaluate what they have learned through practice (Chaffey *et al.*, 2012). It is critical to ensure that students can apply information to their daily lives through teaching, learning, and assessment (Chng, 2018). Therefore, students can apply theoretical knowledge to practice through the reflective practice process (Colomer *et al.*, 2020). This study focuses on formulating guidelines for developing Human-Computer Interaction (HCI) students as reflective practitioners. RP is used as a framework of ideas.

An overview of the application for the RP (F in FMA) for developing HCI students as reflective practitioners is presented in Section 4.2. Section 4.3 presents the M in FMA in terms of the approaches to reflective teaching and learning. Different RP models are discussed, and initial guidelines are formed with the aim of enhancing them in subsequent chapters. Section 4.4 presents A in FM in terms of different aspects that relate to RP activities and processes. The guidelines emerging out of this chapter from the literature study are refined and consolidated to remove duplicates in Section 4.5. Section 4.6 provides the summary for the chapter.

4.2 Reflection defined (F in FMA)

Reflection is a popular development in the teaching and learning space. Its definitions are abundant, and one's perspective on the many aspects that are related to reflection depends on the context within which reflective practice takes place. Petsilas *et al.* (2019) affirm that it is possible to express reflection in many different ways, through a variety of disciplines and mediums, as well as through symbolic and metaphorical expressions. Therefore, there is no universally accepted definition (Miraglia & Asselin, 2015).

According to Griggs *et al.* (2018), there are several different definitions of reflective terms in the literature, including reflexivity, reflective practice, reflective learning, and critical reflection, resulting in confusion over their meanings. Some interpret reflection as a pondering exercise, while others see it as a practice that has a particular meaning and is also linked to action (Loughran, 2002). Boud *et al.* (2013) define reflection as a method of determining what one's life experiences are about by questioning and finding out the deeper meaning of that life experience. As a result of reflection, new insight, meaning, and higher levels of understanding are developed (Loughran, 2002; Patil, 2013b). Also, reflection contributes to improved learning by establishing a new theory (Larrivee, 2013), and consequently improves learning (Loughran, 2002). Therefore, it is suitable to incorporate reflection to enrich and strengthen the traditional ways of conducting teaching and learning practices.

There is a need to enable students to think differently and encourage them to be objective about their learning. Through the use of reflection methods, it is possible to correct conceptual misunderstandings and errors in problem-solving (Mezirow, 1987). The reflection process also makes it possible to develop new understandings of practical situations, which enhances the actions to be applied to them (Ghaye, 2010).

In order to gain a deeper understanding, it is important to make judgments about the quality of practice (Jay & Johnson, 2002) and to be willing to improve it (Taole, 2015). This can be achieved through the instructors' observations and analysing the progress of students' learning processes. According to Taole (2015), instructors who

analyse their work are better able to determine whether the instructive methods they implement are helpful to their students.

The result of this chapter is a set of guidelines from literature for using reflective practice for HCI students. These guidelines are defined as they emerge from the discussion. The first guideline, along with a code, is presented in Table 4.1. The code ERP_Def code stands for emerging guideline from defining reflection.

Table 4.1: Emerging guideline from defining reflection – ERP_Def1

ERP_Def1: Quality of practice	Improve the quality of practice by observing and analysing the progress of students' learning processes they undertake.

Apart from teaching and learning, RP imparts critical thinking abilities and a questioning mentality in people, not just about their work but also about the environment in which they operate (Grant *et al.*, 2017). RP can assist in understanding and changing prior events by offering vital insights into how individual ideas and experiences in the industry (Geng *et al.*, 2019). Based on this information, the individuals who engage in RP can develop a better understanding of their actions by thinking them through.

To summarise the literature explored in this section, reflection means contemplating the actions taken to make meaning out of what you know and understand. In other words, reflection allows the students to examine their work and create a strategy for future improvements. A critical component of lifelong learning is reflection, which is recognised as one of the most important transferable competencies in both professional and personal development (Colomer *et al.*, 2020). Therefore, reflective thinking helps with personal growth to decide on what course of action to take.

The guideline that emerged from this segment of defining reflection is presented in Table 4.2.

Table 4.2: Emerging guidelines from defining reflection – ERP_Def2

ERP_Def2: Lifelong learning	Assist students to employ reflective practice when they learn with the aim of developing professionally or personally.

With the information presented, reflection in this study is viewed as a strategy that enhances one's understanding regarding the actions that one undertakes or plans to take to complete the work and to improve. In the process of understanding what one knows and does in practice, one is continually presented with the concept of reflecting to help one learn more (Loughran, 2002).

The guideline that emerged from this segment of defining reflection is presented in Table 4.3.

Table 4.3: Emerging guidelines from defining reflection – ERP_Def3

ERP_Def3: Reflective practice strategy	Integrate reflective practice as a strategy into students learning to assist them to complete the work and how to improve their learning.

RP is associated with the process; and the outcome thereof is a reflective practitioner (Karnieli-Miller, 2020). Taking this into account, RP is a process that involves reflection and the individual who puts RP into practice develops into a reflective practitioner. This view is supported by Thu (2019), who states that the illustration of reflection is RP. As a result, RP is a strategy for learning and not content that can be learned (Dors *et al.*, 2020).

The guidelines that emerged from this section of defining reflective practice are presented in Table 4.4.

Table 4.4: The emerging guidelines – defining reflection

ERP_Def1: Quality of practice	Improve the quality of practice by observing and analysing the progress of students' learning processes they undertake.
ERP_Def2: Lifelong learning	Assist students to employ reflective practice when they learn with the aim of developing professionally or personally.
ERP_Def3: Reflective practice strategy	Integrate reflective practice as a strategy into students learning to assist them to complete the work and how to improve their learning.

4.2.1 Historical background of Reflective Practice

The term 'reflective practice' is credited to the work of Schön and Dewey (Murphy & Ermeling, 2016; Ng *et al.*, 2015). Scholars such as Hébert (2015); Kinsella (2010) and Ejsing-Duun and Skovbjerg (2019) have followed in the footsteps of Schön and/or Dewey when writing about RP. The research by Hébert (2015) traces the ideological lineage of RP as an evaluative model in education and discusses how Dewey's model is about knowledge and Schön's model is about the experience, favouring knowledge over experience. From this perspective, it is noted that the work of Schön is based on Dewey's work, where Schön focuses on the result, whereas Dewey focuses on the implementation approach (Teekman, 2000).

In this section, the works of Dewey (Section 4.2.2) and Schön (Section 4.2.3) are discussed to establish the historical background. Section 4.2.4 discusses constructivism in terms of Dewey and Schön's works.

4.2.2 John Dewey

Dewey (1859 – 1952) was an American philosopher in the field of education, born in Vermont (Kesson, 2021). He is well respected as one of the outstanding educational theorists who identified the concept of reflective thinking. According to Zalipour (2015), John Dewey realised that when people encounter problems, they can reflect on them by thinking about them. The concept of reflection is identified in his book, *How we think* (Dewey, 1933). In this book, he does not support the idea of accepting any recommendation at first but thinking it over by reflecting on it. Reflecting on the matter involves thinking and looking for more information that will confirm what was recommended. Dewey is not the only one who recognised that reflection enhances one's ability to think differently. Van Rensburg *et al.* (2018) also noted in their study that in professional or academic situations, reflection rejects the idea that there is a one-size-fits-all answer. Dewey asserted that reflective thinking exists and that it is an exceptional stream of thought patterns that are different from what we are used to. Dewey (1933) maintained that reflective thinking, which involves cautious and critical consideration of implicit knowledge, breaks people free from routine actions driven by impulse, tradition, and authority. His concept of reflection does not include a range of steps to be followed, but rather, it is a holistic way of accomplishing a

solution to the questions. With this in mind, reflection is not a consistent process or method which will work for everyone. The guideline that emerged from this segment of John Dewey's work is presented in Table 4.5.

Table 4.5: Emerging guideline from John Dewey's work – Dewey1

Dewey1: New situation	Promote attempting a new task through careful reflection and contemplations of available knowledge frameworks. • The task should be a hands-on application of explicit identified knowledge in a specific situation

Dewey proposed three attributes that are essential to reflective practice:

- *Open-mindedness* is characterised by a new way of thinking or understanding. Dewey's definition of open-mindedness means being open to alternative viewpoints that can be considered before making any decision.
- *Responsibility* is always being accountable for one's own actions and reactions. Dewey's definition of responsibility refers to reflections that are taken with a keen eye towards consequences; that is, how our reflections influence those who are affected.
- *Wholeheartedness* involves always being sincere and showing enthusiasm for different ideas. Dewey equates wholeheartedness to evaluating one's practice with the aim of identifying a solution.

The guidelines that emerged from the attributes that are essential to reflective practice are presented in Table 4.6.

Table 4.6: Emerging guidelines from attributes of RP according to Dewey

Dewey2: Open-mindedness	Evaluate different viewpoints before making any decision.
Dewey3: Responsibility	Examine who gets affected by the reflections made.
Dewey4: Wholeheartedness	Identify a solution by evaluating your own practice to improve it.

According to Zeichner and Liston (2013), Dewey guides us to the correct path with his formulation, but others, particularly Schön, have expanded on the concept to demonstrate how it can be integrated into our day-to-day living.

The next section presents the work of John Dewey.

4.2.2.1 John Dewey's work

The term 'experiential' learning can be traced back to the work of Dewey (1938). He acknowledged that experience on its own does not bring about learning. Dewey (1938) posited that the belief that experience is a by-product of a legitimate education does not mean that one can learn from experience or that the experience is real. He also believed that undertaking a simple activity did not signify experience (Dewey, 1966). However, 'practical knowledge' or 'know-how' is produced using experiential learning (Teekman (2000). It appears that, according to Dewey, acting in the world, as well as understanding it, is what the development of an educative experience is about.

Learning is a lifelong journey for certain individuals, and therefore, education should be rooted in experience to fulfil the objectives of society (Dewey, 1938). Individuals' lives, therefore, are comprised of the experience that is at the core of experiential learning (Ord, 2012). Dewey (1966) contended that reflecting on the experience is important to extract the meaning and utilise that meaning as a guideline for future experiences. In that way, experiential learning contributes significantly to lifelong learning.

The next guideline that emerged from this section of John Dewey's work about experiential training is presented in Table 4.7.

Table 4.7: Emerging guideline from John Dewey's work – Dewey5

Dewey5: Reflecting on the experience	Administer reflective practice exercises for the students by asking them to specify the significance of their experiential learning to extract the meaning of their experience.

Figure 4.2 is an illustration of Dewey's experiential learning. The model integrates experience and concepts, observation and action with learning as a focus for the reasoning process (Kolb, 1984). The driving power for the different views is derived from the impulse of observation and opinions to provide a directive to impulses (Kolb, 1984).

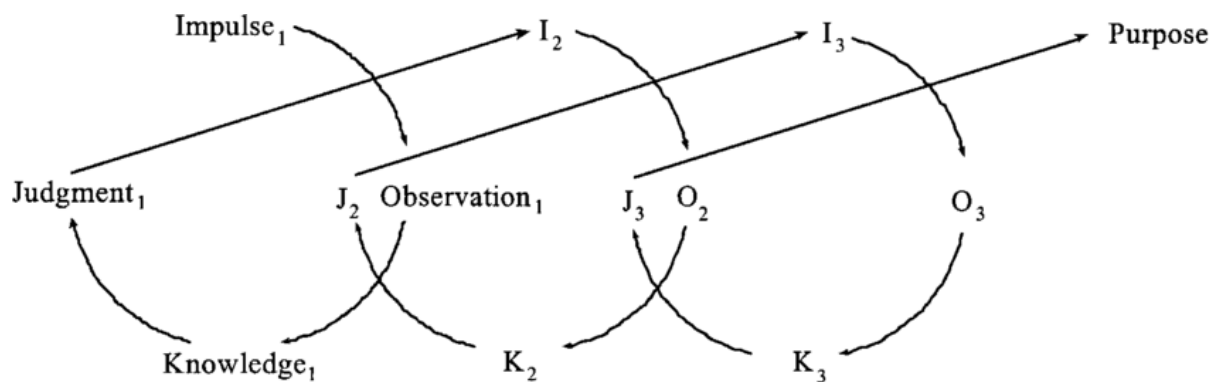


Figure 4.2: Dewey's model of experiential learning according to Kolb (1984)

The summary of guidelines derived from the section on Dewey's views on experiential learning is presented in Table 4.8.

Table 4.8: Emerging guidelines from Dewey's work

Dewey1: New situation	Promote attempting a new task through careful reflection and contemplation of available knowledge frameworks. • The task should be a hands-on application of explicit identified knowledge in a specific situation
Dewey2: Open-mindedness	Evaluate different viewpoints before making any decision.
Dewey3: Responsibility	Examine who gets affected by the reflections made.
Dewey4: Wholeheartedness	Identify a solution by evaluating your own practice to improve it.
Dewey5: Reflecting on the experience	Administer reflective practice exercises for the students by asking them to specify the significance of their experiential learning to extract the meaning of their experience.

The next section presents the views of critics of John Dewey's work.

4.2.2.2 Critics of John Dewey's work

Even though Dewey's work is praised by several authors, it has also received some criticism. Ord (2012) criticised his educational philosophy as being more of an application focusing on making inquiries.

Conceptualising experiential learning according to Dewey's understanding gives rise to questions about its disconnection of reflection and its position in experiential learning (Ord, 2012). Dewey's work has also been criticised in that the model favours rational knowledge above knowledge that is gained from practice, even though the model seems to consider practical work (Hébert, 2015).

The next section presents the work of Donald Schön.

4.2.3 Donald Schön

The concept of RP was emphasised by Schön (1983c). Donald Schön (1930 – 1997) was a philosopher and educational researcher born in Boston. He is most known for his research on RP (Ramage & Shipp, 2020). Zeichner and Liston (2013) affirm that he is regarded as a thought leader on RP. Many scholars maintain that Schön's work was founded upon Dewey's work (Muhtorovna, 2020; Rogers, 2020; Tannebaum *et al.*, 2013; Teekman, 2000; Waks, 2001). Schön (1983c) advanced the approach to RP with reflection-in-action and reflection-on-action concepts which are explored in this study and are discussed further in section 4.2.3.1 of this chapter. According to Schön (1983c), we can undertake actions naturally in different professions without thinking about the process, before or in the course of doing the work, using past experience (Zeichner & Liston, 2013). By using past experience when performing a task, one is in a position to criticise, examine, and improve their experience (Zeichner & Liston, 2013). According to Schön (1983c), the experience can be developed through reflection. Reflection is regarded as a significant component of professional development through learning by challenging our beliefs and understandings (Graham, 2017).

The guideline that emerged from this section on Schön's work about past experience is presented in Table 4.9.

Table 4.9: Emerging guideline from Schön's work – Schön1

Schön1: Past experience	Conduct reflection exercises to help students to reflect on their past experience to learn from it.

Schön published *The Reflective Practitioner* (1983c), and he recognised that change was required in professional practice, and guidance was needed to deal with real-life problems in practical settings where it was not clear how to deal with them when they arise (Waks, 2001). The book starts with a description of how problems are normally solved in professional practice and how knowledge comes about in the process of solving problems. The argument is that practitioners deal with problems in their professional work that they might not be trained to solve. He indicates how this problem affects the practitioners' work and causes them not to be productive in their work. This is where Schön formulated the term "reflection-in-action" to assist in solving the problems encountered by practitioners during practice. He attested that the concept of reflection goes beyond what the practitioner has been trained to do. According to Munby (1989), it is not clear how reflection-in-action takes place.

Reflection encourages individuals to experiment with various approaches for addressing challenges. Schön mentioned that the nature of the problems could not be predicted by formal theory. This demonstrates the theory-practice gap that can be bridged by reflecting on the situation to seek out new ways of problem-solving. The book states that being a reflective practitioner means going beyond what has been learned during formal training by trying new ways of solving or approaching a situation. Schön argued that the paradigm of "*Technical Rationality*" existed in universities. This is where formal education does not value practical knowledge possessed by the practitioners. This is where what is being accomplished in science and technology is intended to be applied to the lives of the people.

The emphasis that Schön portrayed is that practical knowledge from practice can be acknowledged through reflection (Ziebart & MacDermid, 2019).

4.2.3.1 Schön's reflection-in-action and reflection-on-action

Schön employed the terms 'reflection-in-action' and 'reflection-on-action' to describe that reflection is an ongoing process (Schön, 1983c). They describe reflection during (in-action) and after (on-action) a specific action. Rolfe (2014) argues that, according to Schön, RP takes place during the process of practice not when the process is done. He substantiates his argument by stating that RP refers to "reflection in practice". Schön (1983c) refers to this as 'reflection-in-action'. The reflection-in-action is practically oriented. It is designed to address how experts apply problem-solving skills to situations (Ixer, 1999). The level of a person's intelligence seems to play a critical role in action in practice when reflecting (Ixer, 2012). Reflection-in-action is described as a process where a professional deals with a problematic situation in practice (Schön, 1983c). In other words, an individual can reflect while undertaking an activity and change their approach accordingly to accomplish the desired outcomes through reflection in action (Thomas & Volschenk, 2021).

Table 4.10 presents an overarching guideline from the work of Schön about reflection-in-action along with problem-solving method guidelines.

Table 4.10: Emerging guidelines from Schön's work – Schön2 and Schön3

Schön2: Reflection-in-action	Integrate reflection exercises during the process of practice.
Schön3: Problem-solving method	Reflect on a variety of methods for solving the challenges faced before attempting to solve the problem.

Unlike reflection-in-action, reflection-on-action occurs after the work has been completed. This gives the students the ability to evaluate themselves after gaining knowledge about their actions in completing the work. As a result, they can use their experiences to understand and position themselves for action in the present and the future (Cattaneo & Motta, 2021). According to Wieringa (2011), even though looking back at what has already happened is beneficial, it does not have any impact on the action that was previously taken. With this said, the two can be used together to develop the students as reflective practitioners by starting with reflection-on-action. Reflecting after the action has occurred will set a foundation for reflection by the

students for their future work. However, drawing from an extensive range of sources, Burton (2000) indicates that reflection-on-action relies on memory, which can be imprecise. This means that one must recall a series of events. Figure 4.3 displays the actions that are associated with reflection-in-action and reflection-on-action.

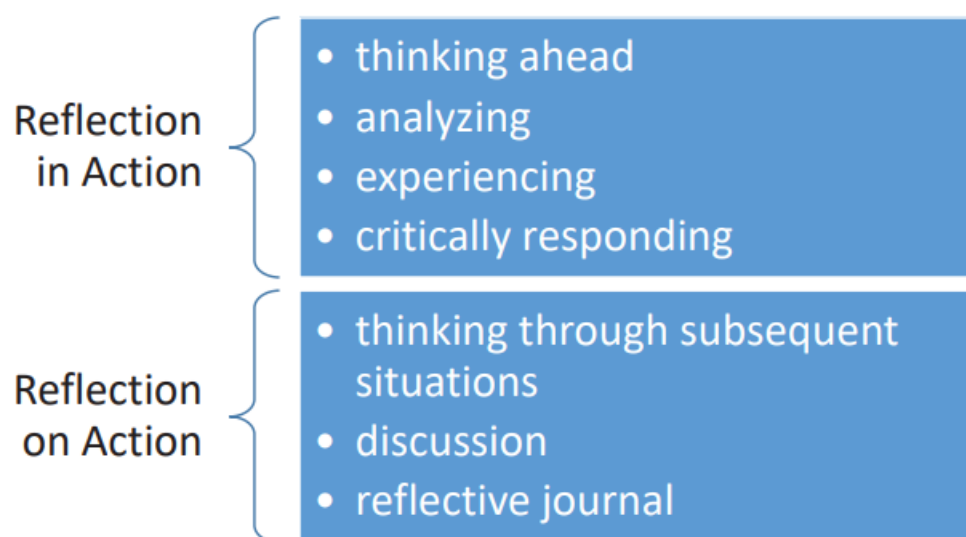


Figure 4.3: Schön's 'reflection-in-action' and 'reflection-on-action' (Gordon, 2017)

Schön's 'reflection-in-action' and 'reflection-on-action' concepts are regarded as significant contribution to RP (Willis, 2010). A guideline derived from reflection-on-action is presented in Table 4.11.

Table 4.11: Emerging guidelines from Schön's work: Schön4

Schön4: Reflection-on-action	Facilitate the reflection process (exercise) after completing the practical experience.

4.2.3.2 Critics of Schön's work

Even though Schön is an influential leader where RP is concerned, his work has also been criticised. According to Anderson (2019), Schön's work is widely cited in the professional learning discipline; however, his work offers limited guidance in classroom teaching. For the purpose of influencing transformational learning, reflection-in-action needs to be improved with reflection-beyond-action to improve, among other things, lifelong learning and advanced practice development to assist professionals who are at the beginning stage of their careers with RP (Edwards,

2017). It is debatable whether Schön's examples will apply to or address the needs of professions that work with people directly, such as doctors, educators, and nurses because his examples are based on a virtual world that does not have the distractions found in real-life situations (Teekman, 2000). The emphasis on life-long learning and the benefits of being a reflective practitioner have led to the development of the guideline presented in Table 4.12.

Table 4.12: Emerging guideline from Schön's work: Schön5

Schön5: RP as a lifelong learning strategy	Develop an awareness of the benefit of RP to achieve life-long learning resulting from the fast pace of technological change.

The summary of the guidelines from Schön's work is presented in Table 4.13.

Table 4.13: Emerging Schön' s work guidelines

Schön1: Past experience	Conduct reflection exercises to help students to reflect on their past experience to learn from it.
Schön2: Reflection-in-action	Integrate reflection exercises during the process of practice.
Schön3: Problem-solving method	Reflect on a variety of methods for solving the challenges faced before attempting to solve the problem.
Schön4: Reflection-on-action	Facilitate the reflection process (exercise) after completing the practical experience.
Schön5: RP as a lifelong learning strategy	Develop an awareness of the benefit of RP to achieve life-long learning resulting from the fast pace of technological change.

The next section looks at how constructivism relates to RP.

4.2.4 Constructivism

Reflective practice is an approach to professional development with roots in constructivism (Osterman, 1998). Constructivism is defined as an act of making sense of what one has learned (Suhendi *et al.*, 2021). Mvududu and Thiel-Burgess (2012) describe constructivism as a way of thinking and learning, but constructivism

is also a method of teaching that helps students to effectively understand and absorb what is being taught.

Various authors have argued that constructivism is central to Donald Schön's theory of reflective practice (Kinsella, 2006; Osterman, 1998) and it is rooted in the thinking of John Dewey (Gash, 2014; Kivinen & Ristela, 2003). Dewey is also considered an important contributor to the evolution of constructivism through his educational theories (Cavana, 2009). A fundamental concept of his philosophy is the notion that education can be viewed from both an educational perspective and a philosophical viewpoint (Reich, 2007). Using constructivism, Dewey argues that individuals can shape themselves and their social knowledge (Suhendi & Purwano, 2018).

According to Narayan *et al.* (2013), knowledge is not simply transmitted to someone but must be constructed by them. They further argue that students have prior cultural knowledge that they bring to the learning environment; they do not come without knowing anything. It is through the integration of new information with what students already know (prior knowledge) that they learn (Bada & Olusegun, 2015).

Some topics may require students to form mental models based on their previous experience and cognitive capabilities, even if they are unaware of them or have no prior experience (Jia, 2010). Constructivism coincides with RP. According to Mantzourani *et al.* (2019), RP also enables students to draw on past experiences. Mvududu and Thiel-Burgess (2012) assert that constructivism emphasises the importance of building on prior knowledge. Qiu (2019) also maintains that according to constructivism, learning is the process of constructing meaning and understanding from prior knowledge.

Constructivism has influenced the way learning is observed. In this study, the views of Hein (1991); Suhendi *et al.* (2021); Yaman (2020) and Clark (2018); Mvududu and Thiel-Burgess (2012) about how constructivism supports the reflective practice process are discussed. According to Yaman (2020), the emphasis has shifted on how information is processed in the minds of the students, the mental steps they take when they learn, and their perception of writing as a significant and social activity. It is argued that during the process of learning, students construct meaning individually and socially (Hein, 1991; Suhendi *et al.*, 2021). The constructivist

approach to education allows instructors to take into account the prior knowledge that students have acquired (Mvududu & Thiel-Burgess, 2012). As Clark (2018) maintains, new information is best acquired by students when they actively construct their own meanings based on that information.

The next section discusses the approaches to reflective learning.

4.3 Approaches to reflective teaching and learning (M in FMA)

To implement reflective practice, the key point is to ask relevant questions. This can aid in determining whether there were any lost chances throughout the learning process and what may be improved. According to Juklová (2015), the objective of reflective practice is to acquire students' perspectives on the advantages, impediments, and constraints of incorporating reflective learning approaches into class and action plans. This data is fundamental in assessing the applied experiences. Different scholars such as John Dewey, Donald Schön, David Kolb, and Gibbs have developed approaches for how to promote reflective practice. Within this study, it is believed that incorporating reflective practice approaches into student learning would enhance their reflection and learning skills.

The emerging guideline from this section of approaches to reflective teaching and learning is related to reflecting during learning and it is presented in Table 4.14. Since the guideline emerged from different authors, emerging reflective teaching and learning literature code (ERTL_Lit) was used for the emerging guideline for this section.

Table 4.14: Emerging guideline from approaches to reflective teaching and learning: Lit1

ERTL_Lit1: Reflecting during learning	Inspire students to add reflection as a key process in their learning cycle.

Several approaches can be applied to promote reflection, and among them are Schön's reflection-in-action and reflection-on-action (Section 4.2.3.1), John Dewey's experiential learning (Section 4.2.2.1), Kolb's experiential learning (Section 4.3.1),

and Gibbs reflective learning (Section 4.3.2). Kolb and Gibbs' models are discussed next.

4.3.1 Kolb's experiential learning

The experiential learning advocated by Kolb (1984) originates from the work of Dewey (1938). His study of experiential learning is rooted in the works of John Dewey, Kurt Lewin, and Jean Piaget (Kolb, 1984). The work of Kolb (1984) is based on developing and testing out a theory in practice with an emphasis on students drawing on the extensive experience they bring to their learning and improving on it throughout their lives (Bulman & Schutz, 2013). According to Kolb (2014), the process of gaining knowledge throughout life is derived from an effective connection between theory and experience. Linking theory with practice enables practitioners to create meaningful theories of action that are grounded in reality (Bulman & Schutz, 2013). The context in which experience takes place incites the development of behaviour with purpose and ambition (Kolb, 1984). He further states that experience is the result of interacting with theory and practice.

From this section of Kolb's experiential learning, an emerging guideline related to theory and practice is presented in Table 4.15.

Table 4.15: Emerging guideline from Kolb's experiential learning - Kolb1

Kolb1: Link theory with practice	Allow students to evaluate what they have learned (theoretically) through practice.

After examining the three models of experiential training by John Dewey, Kurt Lewin, and Jean Piaget, Kolb (1984:25) realised that there were similarities among the models and described the characteristics of experiential learning as follows:

- It is best to view learning as a process rather than as a result;
- Experience is the best basis for learning;
- The resolution of conflicts between dialectically opposing modes of adapting to the world is the basis of learning;
- An important aspect of learning is adjusting to the surrounding environment;

- Interactions between the individual and their environment are crucial to learning;
- Learning occurs as a result of the interaction of social and personal knowledge.

Grant *et al.* (2017) state that the experiential learning model, which is also referred to as the learning strategies developed by Kolb (1984), is used to assist students in their learning and develop real meaning from experience. The purpose of developing the experiential model was to act as a guide for students through the stages to understand and adapt to learning (Kolb, 1984). Kolb's experiential learning comprises four stages in which learning can take place; namely concrete experience, reflective observation, abstract conceptualisation, and active experimentation as illustrated in Figure 4.4.

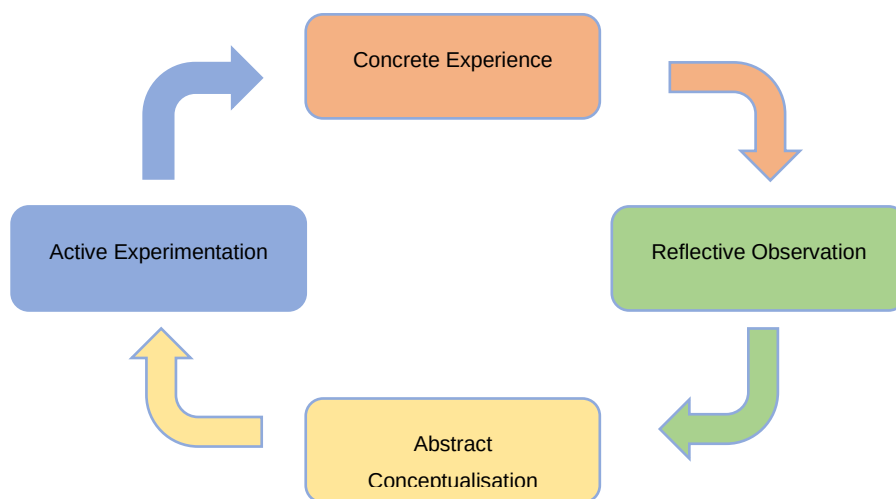


Figure 4.4: Experiential learning cycle (Kolb, 1984)

The experiential learning stages are presented as follows:

- *concrete experience* – this stage is where students are given an assessment to complete and it is graded (Schultz *et al.*, 2016). The concrete experience involves students performing the new task, thus gaining hands-on experience (Konak *et al.*, 2014). To achieve the desired learning outcome, the task should be based on a recent lesson (Schultz *et al.*, 2016). This type of experience has the ability to provide the students with an opportunity to construct their knowledge by applying theory to complete their practical assignments. Kolb

(1984) argued that people do not approach situations with no prior knowledge. Instead, they bring past experiences that contribute to their understanding of the situation.

The emerging guideline from Kolb's experiential learning section as it relates to concrete experience is presented in Table 4.16.

Table 4.16: Emerging guideline from Kolb's experiential learning - Kolb2

Kolb2: Concrete experience	Provide the students with an exercise that will allow them to construct their knowledge when they apply theory to complete their practical assignments.

- *reflective observation* – direct concrete experience is the foundation for reflective observation, where the observations are incorporated into theory and new experiences are formed (Boud *et al.*, 2013). During the reflective observation stage, students are expected to document what went well and the challenges they experienced that they will need to improve on (Schultz *et al.*, 2016). The process of reflection takes place after the students have completed their practical experience in a dialogue form or been assigned the questions that will enable them to reflect on what they have completed (Konak *et al.*, 2014). In this study, applying HCI theory to practice will highlight the importance of applying theory in their practice.

The emerging guideline from reflective observation is displayed in Table 4.17.

Table 4.17: Emerging guideline from Kolb's experiential learning - Kolb3

Kolb3: Reflective observation	Facilitate the reflection process (exercise) students are expected to document what went well and the challenges they experienced that they would need to improve.

- *abstract conceptualisation* – the evaluation of problem-solving approaches and the decision-making process by the students takes place (Schultz *et al.*, 2016).

This process can be enhanced by supporting the students to broaden their understanding by asking probing questions (Schultz *et al.*, 2016). Students can be asked to think about what happened and try to explain it, which brings back the element of reflection in this stage (Fewster-Thuente & Batteson, 2018).

The guideline that emerged from the abstract conceptualisation segment is presented in Table 4.18.

Table 4.18: Emerging guideline from Kolb's experiential learning - Kolb4

Kolb4: Abstract conceptualisation	Ask students probing questions that will broaden their understanding.

- *active experimentation* – the application of new understandings into practice takes place by recognising progress (Schultz *et al.*, 2016). The idea is that the students are required to complete a new task that corresponds to the task completed during the concrete experience stage without providing the steps on how to complete the task (Konak *et al.*, 2014). This suggests that the students at this stage are required to be creative by coming up with new ideas on how to complete the task. When students are involved in a task, they become active participants in the process instead of taking the role of a consumer of information or an observer (Kolb, 1984).

The guideline that emerged from this segment is presented in Table 4.19.

Table 4.19: Emerging guideline from Kolb's experiential learning - Kolb5

Kolb5: Active experimentation	Promote the completion of a new task through hands-on application by the explicit application of identified knowledge in a specific situation.

Based on this model, it is noted that fruitful learning is achieved when the student has advanced through all the stages, in which he/she will participate in a new,

concrete experience; actively reflect upon that experience; develop a new idea or form a concept based on that experience, and carry out an active practice based on what they have learned, which will then bring about a new experience by integrating it with past experiences. The effects of the model can be tested practically to provide a guideline when developing new experiences (Kolb & Yeganeh, 2011).

The summary of the guidelines from Kolb's work is presented in Table 4.20.

Table 4.20: Emerging guidelines from Kolb's work

Kolb1: Link theory with practice	Allow students to evaluate what they have learned (theoretically) through practice.
Kolb2: Concrete experience	Provide the students with an exercise that will allow them to construct their knowledge when they apply theory to complete their practical assignments.
Kolb3: Reflective observation	Facilitate the reflection process (exercise) students are expected to document what went well and the challenges they experienced that they would need to improve
Kolb4: Abstract conceptualisation	Ask students probing questions that will broaden their understanding.
Kolb5: Active experimentation	Promote the completion of a new task through hands-on application by the explicit application of identified knowledge in a specific situation.

The next section presents some of the criticism of Kolb's model.

4.3.1.1 Critics of Kolb's model

Although Kolb's experiential learning model has been widely used and it is an established framework for learning, it has also been criticised by several scholars. Matsuo and Nagata (2020) believe that the process of second-order learning is not offered in the model. They, therefore, proposed a six-step model and developed a checklist for deep learning. The model includes the management of emotions before reflection can take place; and the unlearning stage before reaching the experimenting stage. They propose that reflection should not be tested on short-term

assessments, but should be implemented over time, since courses in higher education are semester- or year-long (Bartle, 2015). According to Chng (2018), the model's emphasis is not on problem-solving, but rather on applying concepts and relating them to experiences.

Despite criticism of the model, the work of Kolb is widely used and has also influenced the work of other scholars like Gibbs. The work of Gibbs is discussed next.

4.3.2 Gibbs' reflective learning

The reflective cycle developed by Gibbs (1988) is derived from the work of Kolb (1984), who formulated experiential learning (Bulman & Schutz, 2013; Husebø *et al.*, 2015). It is commonly used in the fields of nursing (Li *et al.*, 2020; Wilding, 2008), healthcare education, education (Grant *et al.*, 2017), and other fields (Arumugam *et al.*, 2017). By using this tool, the user can look at all the key aspects of the situation that is being reflected upon (Willis, 2010). The structure provided usually directs the reflection process (Husebø *et al.*, 2015). Likewise, the study conducted by Markkanen *et al.* (2020) suggests that difficult circumstances can turn into effective learning experiences and the students may be able to maintain attention for reflection when Gibbs' model is used.

Gibbs (1988) developed the reflective learning cycle to indicate that it is not enough to merely gain experience because it can be forgotten, and learning can also be lost. Similarly, Arumugam *et al.* (2017) point out that unless the experience is reflected upon, it can be forgotten. The reflective cycle in Figure 4.5, which consists of six stages, suggests asking questions like "*what happened?*" This type of question will prompt the students to think about the situation and describe the event they have experienced in detail. Asking the students to think about how the situation made them feel may cause a deeper understanding of the situation, which can possibly promote a thought of self-awareness (Willis, 2010). The model emphasises learning from experience and therefore the feelings, opinions, and recommendations for the subsequent actions are considered (Husebø *et al.*, 2015).

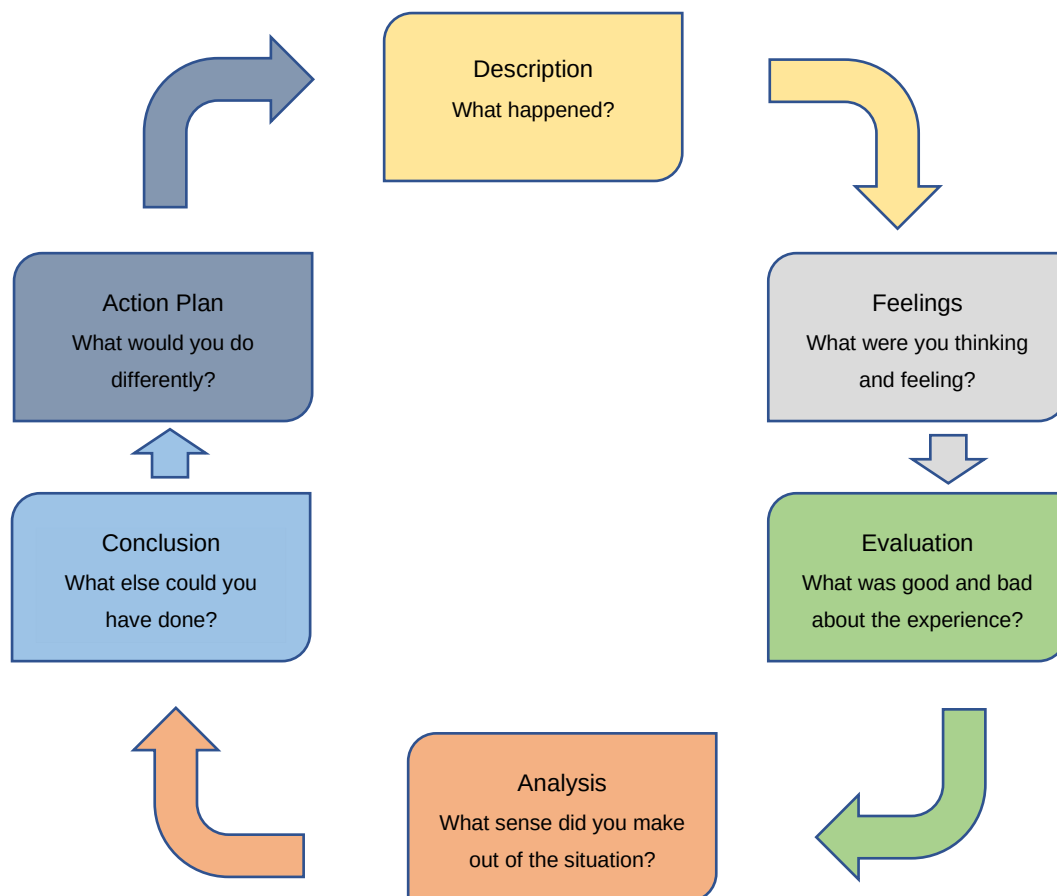


Figure 4.5: Gibbs' reflective cycle (Gibbs, 1988).

The steps indicating how this model of reflection can be applied for the students to reflect after completing a practical assessment are as follows:

- *Description* – this is the first step, which involves describing the event. Students can write down their perceptions as part of the experience, without drawing any conclusions at this stage (Bulman & Schutz, 2013). Grant *et al.* (2017) admit that the description can be complex and advise that it should be kept simple and focus on one event instead of describing what happened throughout the day.

The guideline that emerged from this segment on describing the event from Gibb's reflective cycle is presented in Table 4.21.

Table 4.21: Emerging guideline - Gibbs1

Gibbs1: Description of the event	Ask students to reflect on one event by describing their perceptions and not to make any judgments at this stage.

- *Feelings* – this stage requires the student to disclose their thoughts or feelings during the event. This includes negative and positive thoughts (Arumugam *et al.*, 2017). According to Grant *et al.* (2017), there will be outstanding experiences that will create both negative and positive emotions, that will need to be acknowledged before moving forward to the next stage. These feelings need to be acknowledged so that they do not hinder further learning (Grant *et al.*, 2017).

The emerging guideline from this segment on describing the feelings from Gibb's reflective cycle is presented in Table 4.22.

Table 4.22: Emerging guideline - Gibbs2

Gibbs2: Describe the feelings	Allow students to reflect on their experience of the event by describing their negative and positive thoughts.

- *Evaluation* – the student can make judgments about the event at this stage (Arumugam *et al.*, 2017). Evaluating the experience is about measuring it against a certain standard to determine what went well or what did not go well (Bulman & Schutz, 2013).

The guideline that emerged from this segment on evaluating the process from Gibb's reflective cycle is presented in Table 4.23.

Table 4.23: Emerging guideline - Gibbs3

Gibbs3: Evaluating the process	Document what went well, and the challenges experienced that will need to be addressed in decision-making processes.

- *Analysis* – this stage is meant for the students to make meaning of the reflective training (Kanofsky, 2019). Analysing the experience includes exploring different parts that are reviewed from different points of view to determine if there was another way to respond (Bulman & Schutz, 2013).

The guideline that emerged from this segment on analysis of the experience from Gibb's reflective cycle is presented in Table 4.24.

Table 4.24: Emerging guideline - Gibbs4

Gibbs4: Analysis of the experience	Develop a set of basic skills in order to suggest possible solutions from various perspectives.

- *Conclusion* – after identifying different options, decisions can be made now that more information is available (Bulman & Schutz, 2013). Conclusions may be broad, personal or specific (Kanofsky, 2019).

The emerging guideline from this segment on making a decision from Gibb's reflective cycle is presented in Table 4.25.

Table 4.25: Emerging guideline - Gibbs5

Gibbs5: Making a decision	Make a decision from options that were generated.

- *Action plan* – this stage presents an opportunity to improve the action plan for the subsequent session to apply different ideas (Arumugam *et al.*, 2017). The purpose of reflection is not only for students to improve themselves and to understand their actions and reactions to situations better, but to react better to the same situations in the future by thinking clearly about their thoughts and feelings (Bulman & Schutz, 2013).

The emerging guideline from this segment on planning skills from Gibb's reflective cycle is presented in Table 4.26.

Table 4.26: Emerging guideline - Gibbs6

Gibbs6: Planning skills	Develop specific strategies for planning that explicitly incorporate identified suggested solutions.

The summary of the guidelines from Gibbs' work are presented in Table 4.27.

Table 4.27: Emerging guidelines - Gibbs' literature

Gibbs1: Description of the event	Ask students to reflect on one event by describing their perceptions and not to make any judgments at this stage.
Gibbs2: Describe the feelings	Allow students to reflect on their experience of the event by describing their negative and positive thoughts.
Gibbs3: Reflection of the process	Document what went well, and the challenges experienced that will need to be addressed in decision-making processes.
Gibbs4: Analysis of the experience	Develop a set of basic skills in order to suggest possible solutions from various perspectives.
Gibbs5: Making a decision	Make a decision from options that were generated.
Gibbs6: Planning skills	Develop specific strategies for planning that explicitly incorporate identified suggested solutions.

Gibbs' work guides one on how the process of reflection can be followed. The next section presents the critics of Gibbs' model.

4.3.2.1 Critics of Gibbs' model

Even though Gibbs's work has been cited by several scholars, it has not escaped criticism. Critics have claimed that the model's cycle appears to be excessively lengthy and confusing for certain professions, including pre-hospital practitioners (Willis, 2010). Professionals get confused by the evaluation and the analysis stages in the sense that they appear to be similar components. Another criticism of the framework is the lack of guidance regarding what to do at the analysis stage (Grant *et al.*, 2017). Another criticism of Gibbs' model is found in the study done by Timmins *et al.* (2013) who assert that the elements of the model such as analysis, evaluation,

and conclusion seem to overlap and consequently result in confusion for the staff as well as students. Goulet *et al.* (2016) suggest that the model needs to be adjusted further for local use.

4.3.3 Zwozdiak-Myers' dimensions of reflective practice

It is crucial that higher education instructors regularly reflect on their teaching and provide dynamic and relevant instruction (Lubbe & Botha, 2020). According to Zwozdiak-Myers (2011), RP is a process of organising and reorganising knowledge and theories to inform teaching practice. A framework was developed by Zwozdiak-Myers (2011) to make it easier for instructors to provide evidence to inform their own teaching practices as displayed in Figure 4.6.

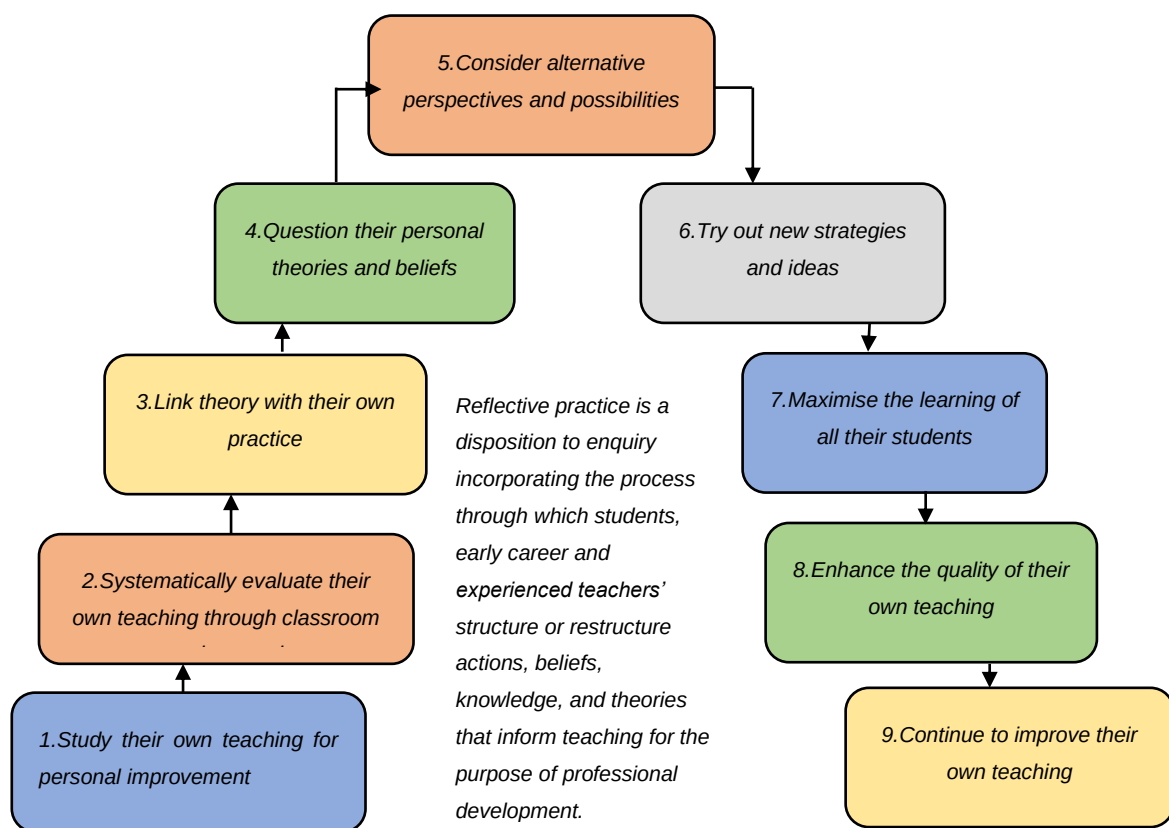


Figure 4.6: Dimensions of reflective practice based on the work of Zwozdiak-Myers (2011)

The dimensions of reflective practice are briefly presented below. The work of Zwozdiak-Myers (2011) draws from the work of Dewey (1933).

4.3.3.1 Dimensions of reflective practice

According to Zwozdiak-Myers (2011), there are nine identified discrete, yet interconnected dimensions of reflective practice, which encompass significant and diverse topics, mainly concerning the nature and translation of the reflective activity into professional practice. The dimensions are briefly presented below:

Dimension 1: Study their own teaching for personal improvement

Drawing from Kolb's work, reflection in this dimension is informed by concrete experiences as a foundation for reflection and observation. By translating concrete experiences into abstract concepts, one can develop new possibilities for taking action, which can be tested through experiments. The reflections at this point assist instructors to understand themselves.

The emerging guideline from the segment *on studying their own teaching for personal improvement* is presented in Table 4.28.

Table 4.28: Emerging guideline from studying their own teaching for personal improvement - Zwodiak1

Zwodiak1: Personal development	Complete an exercise that will allow the construction of knowledge when completing a practical experiment.

Dimension 2: Systematically evaluate their own teaching through classroom research procedures

The notion of the instructor as a researcher of one's classroom experience is viewed as essential to systematic reflection. Using formative evaluation in the classroom can allow instructors to translate feedback into modifications, adjustments, and areas for further action. As a result, instructors were able to make decisions about what actions to take based on their specific situation and thus improve their teaching quality.

The guideline that emerged from the segment *on systematically evaluating their own teaching through classroom research procedures* is presented in Table 4.29.

Table 4.29: Emerging guideline from the segment on systematically evaluating their own teaching through classroom research procedures - Zwodiak2

Zwodiak2: Evaluate own teaching	Use feedback from formative evaluation in the classroom to make adjustments for further action.

Dimension 3: Link theory with their own practice

In order to connect theory and practice, instructors must be researchers. Their professional role includes providing critical analysis of research evidence.

The guideline that emerged from the segment on *linking theory with their own practice* is presented in Table 4.30.

Table 4.30: Emerging guideline from the segment on linking theory with their own practice - Zwodiak3

Zwodiak3: Link theory with practice	Conduct research to connect theory and practice.

Dimension 4: Question their personal theories and beliefs

Drawing from the work of Zeichner (1996), the purpose of this dimension is to highlight the fact that instructors' personal beliefs and theories become more explicit when they engage in the reflective process. Failure to re-evaluate personal ideas and beliefs leads to mindless teaching or habitual practice (Mezirow (1990).

The guideline that emerged from the segment about questioning their personal theories and beliefs is presented in Table 4.31.

Table 4.31: Emerging guideline from the segment on questioning their personal theories and beliefs - Zwodiak4

Zwodiak4: Question personal theories and beliefs	Engage in a process of reflection to be more explicit with personal beliefs and theories.

Dimension 5: Consider alternative perspectives and possibilities

This dimension addresses the need for instructors to consider other perspectives by exploring alternatives.

The guideline that emerged from the segment on *considering alternative perspectives and possibilities* segment is presented in Table 4.32.

Table 4.32: Emerging guideline from the segment on considering alternative perspectives and possibilities - Zwodiak5

Zwodiak5: Consider alternatives	Consider other perspectives by exploring alternatives before selecting the solution.

Dimension 6: Try out new strategies and ideas

By asking probing questions prompted by their circumstances, instructors demonstrate that they are interested in their careers. This approach encourages instructors to identify major trends that could affect their classrooms and curriculum.

The emerging guideline from the segment on trying out new strategies and ideas is presented in Table 4.33.

Table 4.33: Emerging guideline from try out new strategies and ideas - Zwodiak6

Zwodiak6: Attempt new strategies	Use different strategies to identify major trends related to classroom and curriculum.

Dimension 7: Maximise the learning of all their students

This dimension is based on the principles of entitlement and inclusion. Customising learning to accommodate individual needs is the key to maximising the learning potential of all students. Different strategies can be explored to ensure that each

student's potential is reached. When planning to advance students' learning, several factors must be considered by instructors:

- Their understanding of students;
- Theoretical perspectives on the process of how learning takes place;
- In terms of progress, what does the student need to do?
- In what ways do specific students' tasks place demands on them?

It is important for instructors to reflect on the effectiveness of maximising student learning potential by designing different learning experiences and a curriculum that caters to the needs of all of the students.

The emerging guideline from the segment about maximising the learning of all students is presented in Table 4.34.

Table 4.34: Emerging guideline from the segment on maximising the learning of all students - Zwodiak7

Zwodiak7: Maximise students' potential learning	Customise learning by applying different strategies to accommodate individual needs.

Dimension 8: Enhance the quality of their own teaching

In order to transform knowledge into meaningful learning experiences for all students, instructors need to acquire a variety of knowledge bases and models for teaching. Teachers can make informed decisions about their future teaching by reflecting on lesson outcomes and how well they have met them, which will enhance their pedagogical expertise.

The emerging guideline from the segment on enhancing the quality of their own teaching is presented in Table 4.35.

Table 4.35: Emerging guideline from the segment on enhancing the quality of their own teaching - Zwodiak8

Zwodiak8: Enhance teaching quality	Reflect on lesson outcomes and acquire a variety of knowledge bases and models for teaching.

Dimension 9: Continue to improve their own teaching

As education continues to evolve, instructors must develop their skills in order to meet the demands of the profession.

The emerging guideline from the segment on continuing to improve their own teaching is presented in Table 4.36.

Table 4.36: Emerging guideline from the segment on continuing to improve their own teaching - Zwodiak9

Zwodiak9: Improve teaching	Enhance teaching skills by using multiple teaching approaches that are in demand in line with specific specialties.

Table 4.37 presents a summary of the guidelines that emerged from this section.

Table 4.37: Emerging guidelines from Zwozdiak-Myers' dimensions of reflective practice

Zwodiak1: Personal development	Complete an exercise that will allow the construction of knowledge when completing a practical experiment.
Zwodiak2: Evaluate own teaching	Use feedback from formative evaluation in the classroom to make adjustments for further action.
Zwodiak3: Link theory with practice	Conduct research to connect theory and practice.
Zwodiak4: Question personal theories and beliefs	Engage in a process of reflection to be more explicit with personal beliefs and theories.
Zwodiak5: Consider alternatives	Consider other perspectives by exploring alternatives before selecting the solution.
Zwodiak6: Attempt new strategies	Use different strategies to identify major trends related to classroom and curriculum.
Zwodiak7: Maximise students' potential learning	Customise learning by applying different strategies to accommodate individual needs.
Zwodiak8: Enhance teaching quality	Reflect on lesson outcomes and acquire a variety of knowledge bases and models for teaching.
Zwodiak9: Improve teaching	Enhance teaching skills by using multiple teaching approaches that are in demand in line with specific specialties.

The next section presents levels of reflection espoused by Rolfe.

4.3.4 Rolfe's levels of reflection

The reflective model proposed by Rolfe *et al.* (2001) is based on three questions: *What? So What? Now What?* In other words, the questions such as what happened, why it has happened, and the related implications, including the action to be taken,

are considered (Paku & Lay, 2011). The model deliberates on the current situation by looking at the problem at hand before making any suggestions. The first level, “*What?*” requires an individual to explain the incident or event being reflected upon. The “*So what?*” level is where the type of theory to be used is considered. At this level, the event that has been mentioned at the “*What?*” level is analysed and evaluated. The next level, “*Now what?*” considers the actions to take in the future.

The guidelines formulated from Rolfe’s levels of reflection model are presented in Table 4.38.

Table 4.38: Emerging guideline from Rolfe’s reflective model (“What”) - Rolfe1

Rolfe1: Reflection of the event (“ <i>What?</i> ”)	Ask students to explain the incident or event being reflected upon.
Rolfe2: Use theory (“ <i>So What?</i> ”)	Identify the theory to be used in order to analyse and evaluate the event.
Rolfe3: Review future actions (“ <i>Now What?</i> ”)	Consider the actions to take in the future.

The development of the model is intended to help healthcare professionals to make a difference in their practices. This model is the simplest and most straightforward with only three levels as compared to the other models discussed in previous sections, Dewey’s model (Section 4.2.2.1), Schön’s model (Section 4.2.3.1), Kolb’s model (Section 4.3.1), Gibbs’ model (Section 4.3.2), and Zwozdiak-Myers’ model (Section 4.3.3). The reflective practice model by Rolfe et al. (2001) is a reflective cycle and is presented in Figure 4.7.

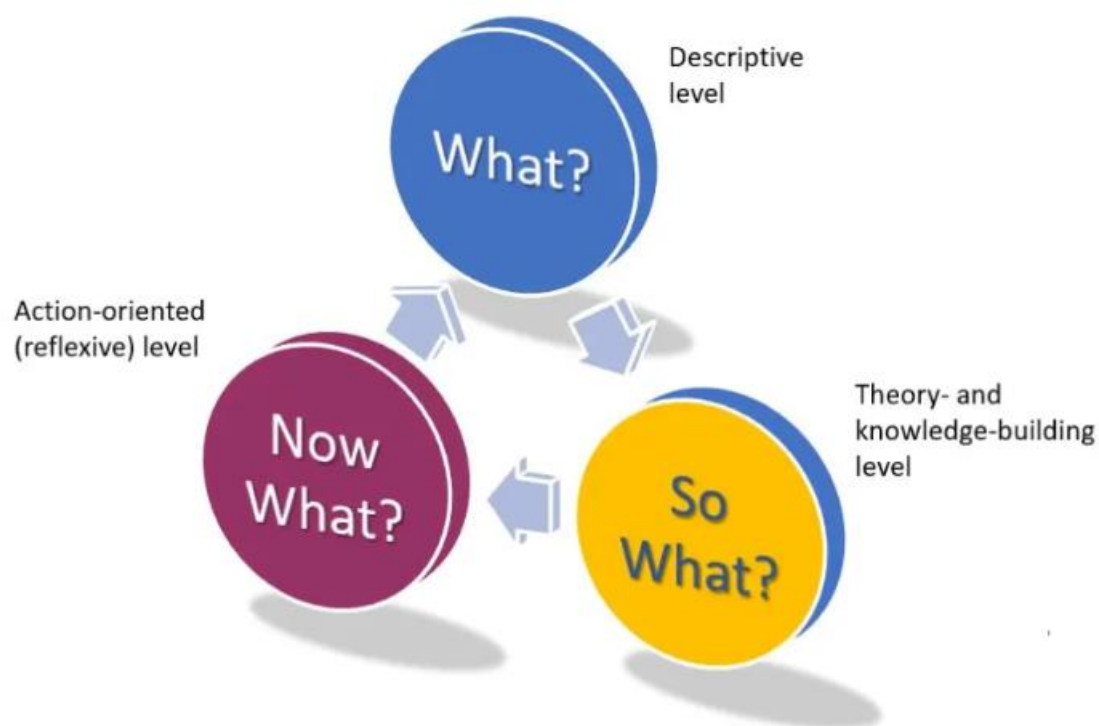


Figure 4.7: Levels of reflection (Rolfe et al., 2001)

Paku and Lay (2011) reported in their study that the students were able to state the “*what*” part, explaining what they had done, but struggled to articulate the other levels, “*so what*” and “*now what?*”

Table 4.39 presents the summary of the guidelines that emerged from Rolfe’s reflective model.

Table 4.39: Emerging guidelines from Rolfe’s reflective model

Rolfe1: Reflection of the event (“ <i>What</i> ”)	Ask students to explain the incident or event being reflected upon.
Rolfe2: Use theory (“ <i>So What</i> ”)	Identify the theory to be used in order to analyse and evaluate the event.
Rolfe3: Review future actions (“ <i>Now What</i> ”)	Consider the actions to take in the future.

The next section presents the reflective model of Joyce-McCoach & Smith.

4.3.5 Joyce-McCoach & Smith teaching model

The model for teaching health professionals in the post-graduate course created by Joyce-McCoach and Smith (2016) came as a result of reviewing several reflective practice models for health professionals. A three-stage teaching model was developed as a result of this review of reflective practice theories, and it has been used for revising subject outcomes, educational activities, and evaluations as presented in Figure 4.8.

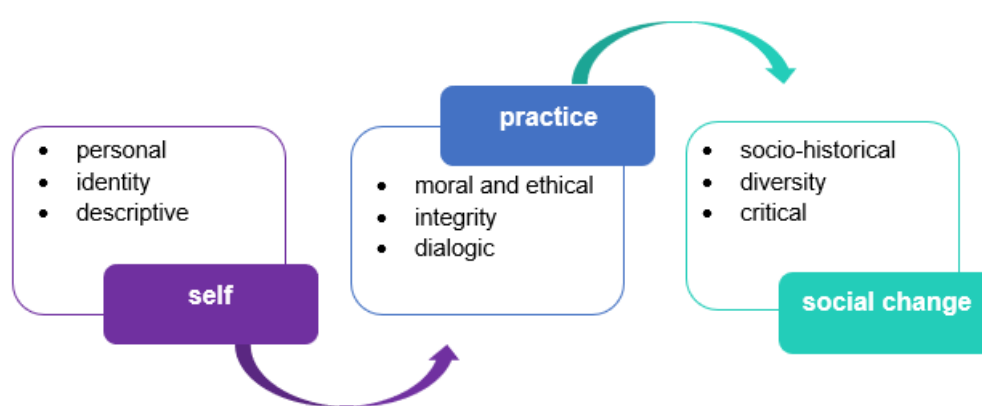


Figure 4.8: Reflective practice teaching model (Joyce-McCoach & Smith, 2016)

As students move through the model, they will realise that reflection is not always a linear process, and that reflective practice is rather a long-term cycle. At the first level, practitioners identify their own values and recognise their own role in healthcare events by exploring their own selves. The second level of student study involves applying insights gleaned from examining oneself to dialogue with external factors within the place of work and related to their practice. The third level involves considering factors beyond the immediate healthcare system, but within which individuals and practices are shaped and defined. By considering the socio-historical context of their practices, at this level practitioners must ask why and how things have become the way they are.

The emerging guidelines that encompass the model created by Joyce-McCoach and Smith (2016) are presented below in Table 4.40.

Table 4.40: Emerging guidelines from Joyce-McCoach & Smith teaching model

McCoach1: Identify own values	Identify own values and recognise own role in the practice.
McCoach2: Apply insights	Identify external factors within the workplace and related to practice to take steps.
McCoach3: External factors	Consider factors that influence individuals and practices outside of the practice domain.

The next section presents the work of Lawrence-Wilkes and Ashmore.

4.3.6 Lawrence-Wilkes and Ashmore

The Reflective Rational Enquiry model was created by Lawrence-Wilkes and Ashmore (2014) to cover the scope of reflective practice. The model came about after reviewing the literature. The literature starts with the perceived difference between those who are considered to be academics and those considered to be professional practitioners. Differences between higher and further education in terms of approach and focus are also highlighted. In critical thinking, critical reasoning and reflection are separated by the theory-practice divide. As a result, there is a conceptual gap between academic knowledge and its practical application in the real world. The model is presented in Figure 4.9.

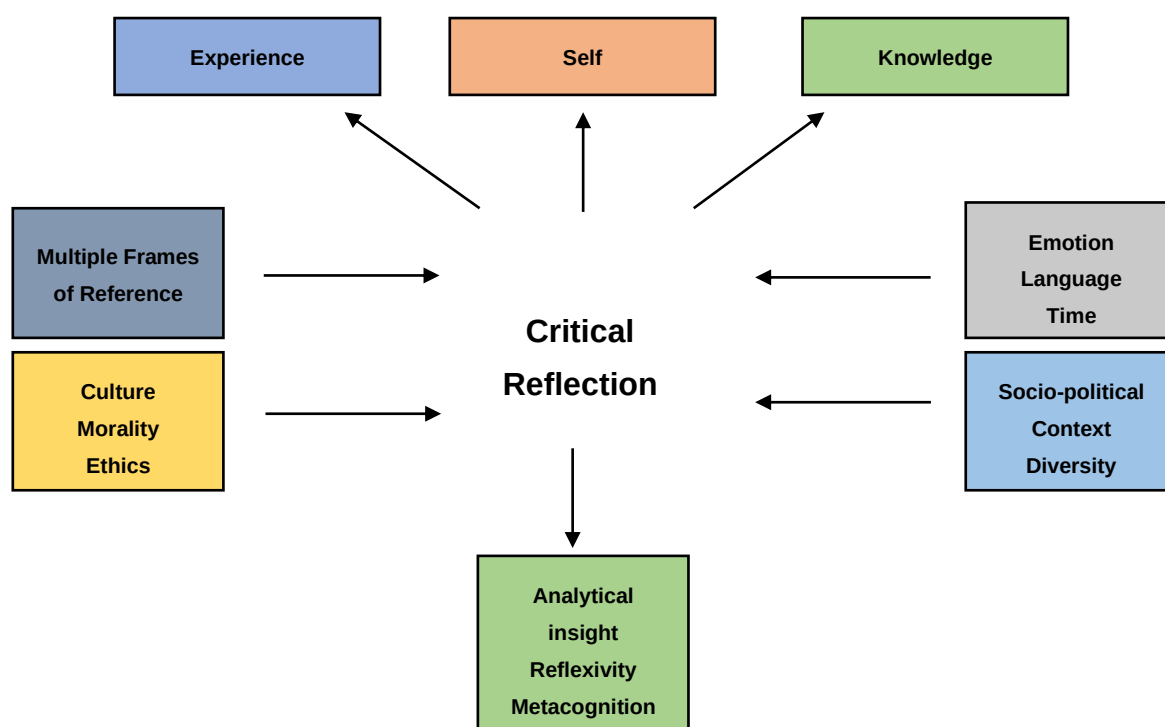


Figure 4.9: The Reflective Rational Enquiry (Lawrence-Wilkes & Ashmore, 2014)

Applied action research, self-reflection, and mechanistic problem-solving are considered to be reflections when reasoning is considered critical thinking. In one proposal, a critical curriculum established on action, self-reflection, and knowledge is suggested. As part of the model, higher-order cognitive forms of critical thinking are also considered.

The guideline that emerged from the section about critical skills in Lawrence Wilkes and Ashmore's Reflective Rational Enquiry model is presented in Table 4.41.

Table 4.41: Emerging guideline from Lawrence Wilkes and Ashmore's Reflective Rational Enquiry model - Lawrence1

Lawrence1: Critical skills	Assist students to apply reflective practice on their reasoning when solving the problems.

By interpreting and analysing formal knowledge, inherent knowledge, and experience using a range of reflective activities, new insights are gained for independent thinking and practice (Brookfield, 1995; Dewey, 1938).

In Table 4.42, an emerging guideline from Lawrence-Wilkes and Ashmore's Reflective Rational Enquiry model is presented.

Table 4.42: Emerging guideline from Lawrence-Wilkes and Ashmore's Reflective Rational Enquiry model - Lawrence2

Lawrence2: Independent thinking	Use a range of reflective activities to interpret and analyse existing knowledge and experience.

Table 4.43 presents a summary of the guidelines that emerged from Lawrence-Wilkes and Ashmore's Reflective Rational Enquiry model.

Table 4.43: Emerging guideline – Lawrence-Wilkes and Ashmore's Reflective Rational Enquiry model

Lawrence1: Critical skills	Assist students to apply reflective practice to their reasoning when solving the problems.
Lawrence2: Independent thinking	Use a range of reflective activities to interpret and analyse existing knowledge and experience.

The next section presents a synthesis of the different models discussed in this chapter.

4.3.7 Synthesis of Reflective Practice models

In this section, the RP components derived from the literature corresponding with each model are presented in terms of their interpretation and practicality. An overview of each model is provided in Table 4.44

The model provided by Dewey (1933) uses reflection and action as a means of implementing knowledge. Based on the model, reflection can only be achieved through practice. The notion of accepting the recommendation without reconsidering it by reflecting on it is rejected. In a classroom setting, information that is relevant and useful is shared with the students. Students' studies are centred on problem-solving. The students are expected to act upon the experience they have gained to

put RP into practice. Through the experience gained, students are expected to have acquired knowledge. Students reflect on experiences, deliberations, beliefs, or knowledge in order to improve their decisions.

The focus of the model by Schön (1983c) is on applying theory to real-world situations. Based on the model, reflective practice is an action that we engage in. A practitioner examines his or her feelings and knowledge critically. Self-reflection is achieved by stepping back from the practice and looking at it from a distance. In a classroom setting, the instructor uses the experience they have to deliver the lesson. By observing or simulating a particular practice, the student might gain a deeper understanding of the facts, rules, and processes involved. Reflection-in-action enables practitioners to solve problems that arise in their practice. Practical knowledge is primarily acquired through on-the-job experience and experimentation. New understandings shape practitioners' actions and also assist them to shape their actions. The practitioners act based on both practical theory and experience. It is through their own experiences that instructors can reframe their thinking. The model can be used to guide the students from the classroom to the working environment.

The emphasis of the model created by Kolb (1984) guides students through the stages of understanding and adaptation to learning. The model assists the students in getting the most out of their experiences and learning. To facilitate self-reflection, students complete a new task without being instructed on how to do so. The assessments completed by the students are graded. Recognizing progress allows for the application of new understandings in practice. Problem-solving approaches and decision-making processes are measured by the students. Experience comes as a result of the interactions that take place in terms of theory and practice.

The model created by Gibbs (1988) is a perpetual cycle of theory and practice which enrich one another. This model is used to review the experience by making judgments about the event. Students can use this model to examine all the key aspects of the situation at hand. The drawback of the model is that reflecting before action is taken is not supported but can only be achieved after an action is taken. The main focus of the model is experience. Evaluations for experience are measured by using a specific standard. Exploring other methods of responding is supported by

analysing the student's own experience. Students can examine their thoughts and feelings to enable them to react better in the future.

The model that was developed by Zwozdiak-Myers (2011) allows instructors to assess new strategies and ideas with the aim of maximizing the students' learning potential. Different methods are used to deliver learning experiences for the students. The instructor's knowledge and theories are organised and reorganised to inform teaching. By using this reflective model, students are able to engage with circumstances that relate to their workplace and profession. The personality and the role of the practitioner are acknowledged. Assessment of attitudes and beliefs is encouraged.

Table 4.44: Reflective Practice models

	Reflective Practice Components	Reflective Practice Models							
		Dewey	Schön	Kolb	Gibbs	Zwozdiak-Myers	Rolfe	Joyce-McCoach and Smith	Lawrence-Wilkes & Ashmore
Rationale	Practicality	Focuses on the implementation approach of knowledge by linking reflection with action	Application of theory to practical settings	Facilitate students' understanding and adaptation to learning by guiding them through the stages	The student can look at all the key aspects of the situation at hand that is being reflected upon	Aims to maximize all students' learning potential	Consider how an event occurred, its outcomes, responses, feelings, and issues	Several methods are used to deliver learning experiences	Activities are undertaken by individuals to explore their experiences leading to understanding
	Studies that used the model	Education	Healthcare, Social work. Education	Education	Healthcare, Nursing, Education	Education, Nursing	Nursing, Care education	Healthcare	Education
Reflection	Reflection	The process of reflection is only possible through practice	Reflective practice is an act that we engage in	Assist students fully in their learning and real meaning from experience	Action must take place before reflection can occur	Organising and reorganising the knowledge and theories to inform teaching	Reflection should take place now to take immediate corrective measures	The practice of understanding and contextualizing oneself	Experience is regarded as an opportunity for growth
	Critical Reflection	Emphasises critical consideration of implicit knowledge	Practitioners critically analyse their feelings and knowledge	Not explicit	Students evaluate their experience by measuring it against a specific standard	Assess new strategies and ideas	It is only through practice that critical reflection can be mastered	Students develop portfolios that explore reflection theories and concepts	Practitioners need to address the increasing theory-practice gap

	Self-reflection	Breaking people free from routine action being driven by impulse, tradition, and authority	Novices need to stand back and look at situations from afar	Students complete a new task without guidance on how to complete	Students analyse their experience by exploring other methods of responding	Personal development is achieved through studying own teaching	Describing what has been learned	Values are identified and a practitioner's role and personality are acknowledged	The ability to reflect more accurately upon one's inner selves
Learning	Classroom setting	The dissemination of relevant and useful information	Teachers use their experience to teach	Students are given the assessment to complete, and it is graded	Not explicit	Instructors conduct systematic classroom research to evaluate their own teaching	Not explicit	Similarities and differences are discussed through learning activities	Not explicit
	Practical lab	Students act upon the experience	A simulation could help the student learn about a specific practice's facts, rules, and procedures	The application of new understandings into practice takes place by recognising progress	A focus is on learning from experience	Not explicit	Not explicit	Students act as social change agents by analysing articles regarding their chosen practices in the media	Not explicit
	Practice setting	Individuals engage and experiment with the environment	Reflection-in-action allows practitioners to resolve problems arising within their practice	Not explicit	Not explicit	Not explicit	Take action to improve the future	Students engage with factors that relate to their workplace and profession	Teacher candidates use the knowledge they gain during coursework to solve problems, make data-driven decisions, and make changes in the field of education.
	Experiential learning	Knowledge is gained through experience	On-the-job experience and experimentation are the major ways that practical knowledge is acquired	Students are actively involved in a new task	Students review their experience	Not explicit	Not explicit	Not explicit	Frames of reference are examined and questioned through experience

Strategies	Evaluate your skills	The focus of students' study is on problem-solving	Practitioners' actions are shaped by new understandings that help them shape their actions	The students evaluate problem-solving approaches and decision-making processes	Students can make judgments about the event by evaluating their experience	Experiment with new strategies and ideas.	Evaluating a new understanding of the situation	Not explicit	Not explicit
	Link theory with practice	Not explicit	Practitioners use both practical theory and experience to act on the spot	Students' experiences are a result of their interactions with both theory and practice.	A perpetual cycle in which theory and practice enrich one another	Instructors link theory with their practice	Move from theory and knowledge level to action-oriented level	Not explicit	The theory is rooted in practice
	Critical analysis of own theories and beliefs	Reflecting on experiences, beliefs, or knowledge intended to improve judgments	Teachers draw from experience to reframe their thinking	Not explicit	Students think clearly about their thoughts and feelings to react better in future	Instructors question their own theories and beliefs	Evaluating the consequences of changing something	Students are encouraged to assess their attitudes and beliefs	Not explicit

The shortcoming of the dimensions of reflective practice model proposed by Zwozdiak-Myers (2011) is that personal development is only achieved through studying own teaching. Instructors conduct systematic classroom research to evaluate their own teaching. The model allows the instructors to link theory with their practice. They also need to question their own theories and beliefs.

The model proposed by Rolfe *et al.* (2001) considers how an event occurred, its outcomes, responses, feelings, and issues. The cycle allows one to move from the theory and knowledge level to the action-oriented level. The emphasis of the model is that reflection should take place now in order to take immediate corrective measures. The purpose of the action taken is to improve the future. It is only through practice that critical reflection can be mastered. The model allows one to attain a new understanding of the situation. The consequences of changing something are also evaluated.

Joyce-McCoach and Smith (2016) created a reflective model where several methods are used to deliver learning experiences. During their studies, students engaged with factors related to their workplaces and professions. The students were required to develop portfolios that explored reflection theories and concepts. The values were identified, and a practitioner's role and personality were acknowledged in this model. Learning activities were used to discuss similarities and differences. Students act as social change agents by analysing media articles regarding their chosen practices. A self-assessment of students' attitudes and beliefs is encouraged.

The reflective model by Lawrence-Wilkes and Ashmore (2014) allows individuals to explore their experiences, leading to understanding by undertaking activities. The model is used mainly in the education sector. Reflection is based on one's experience and this is observed as an opportunity for growth. The increasing theory-practice gap can be addressed by practitioners by using critical reflection. Self-reflection is encouraged for individuals. The students use the knowledge they gain during class to solve problems, make data-driven decisions, and make changes in the field of education. The advantage of using the model is that theory is based on practice.

The next section presents the area of concern of the study; namely the activities of reflective practice.

4.4 Activities of reflective practice (A in FMA)

In this section, the activities that are related to RP are presented. The section starts with the nature of RP in Section 4.4.1. The next section, Section 4.4.2 presents how to learn to reflect. Section 4.4.3 is about reflective writing. Section 4.4.4 provides the learning environment for reflection. The role of RP in education and other professions is discussed in Section 4.4.5. Section 4.4.6 offers how to develop students' reflective skills. The reflective practitioner is presented in Section 4.4.7. Challenges associated with engaging in reflective practice are provided in Section 4.4.8.

4.4.1 Nature of reflective practice

Drawing from different authors, the nature of reflective practice and how it applies to this study are explored. Horton-Deutsch and Sherwood (2017) draw our attention to the fact that reflection is not a passive process but an active experiment that is creative and ultimately leads to progress. Similarly, reflective practice is observed as a new paradigm that is student-centred (Gray, 2007; Helyer, 2015). A student-centred approach is beneficial for HCI students as it enables them to develop their own capabilities when faced with challenges during the completion of assessments.

RP promotes the reviewing of the evidence and a possible plan of action, which leads to an informed decision (Knott & Scragg, 2016). This view is supported by Esterhuizen and Howatson-Jones (2019), who write that students can be empowered through reflection to make progress in their learning by making the right choices.

The emerging guideline from this section on the nature of reflective practice is presented in Table 4.45. The guideline code ERP_Lit1 is used to represent the emerging RP literature guideline.

Table 4.45: Emerging guideline from nature of reflective practice: ERP_Lit1

ERP_Lit1: Review evidence	Use various reflective practice activities to review the evidence and possible action to take.

Educators assert that the emergence of reflective practice is part of a change that acknowledges the need for students to act and think professionally as an integral part of learning throughout their courses of study, integrating theory and practice from the outset (Helyer, 2015). Larrivee (2000) draws on an extensive range of sources to demonstrate that a gap exists between what is developed in academia (theory) and what is applied in organisations (practice). Larrivee (2000) agrees with the view that much of the research conducted in academia is never applied or never becomes known to professionals in business organisations. As a result, reflective learning is the rational analytical process utilised to develop knowledge from experience (Dresch *et al.*, 2014).

The guideline that emerged from this section on the nature of reflective practice is presented in Table 4.46.

Table 4.46: Emerging guideline from the nature of reflective practice: ERP_Lit2

ERP_Lit2: Theory-practice gap	Use reflective practice to develop knowledge from experience.

Students need to draw from past experiences in order to make appropriate decisions about the actions they must carry out. According to Horton-Deutsch and Sherwood (2017), RP guides future actions by revisiting past experiences. RP also assists to incorporate theory into practice (Murphy & Ermeling, 2016). Acquiring practical skills using theory in HCI work is part of being able to apply theory to practice. This means that transformation takes place when students can apply theory to practice.

The guideline that emerged from this section on the nature of reflective practice is presented in Table 4.47.

Table 4.47: Emerging guideline from nature of reflective practice: ERP_Lit3

ERP_Lit3: Reflecting on the experience	Allow students to make appropriate decisions by drawing from past experiences about the action they must take.

Reflective thinking should prompt further inquiry and is, in turn, augmented by it (Maree & Van Rensburg, 2013). There is a demand for lifelong learning, considering new responsibilities that employees must adjust to (Nicol & Dosser, 2016). Helyer (2015) asserts that reflective practice assists individuals to attach meaning to what they do and its purpose or importance. In other words, understanding the reason why something has to be done gives people the motivation to do it.

Engaging in systematic reflection means making it an integral part of daily practice (Mann et al., 2009). The next section discusses an environment that supports reflective practice because students develop an understanding that learning is not a straightforward process, and that reflection assists in making sense of what they have encountered that is not easy to learn. With the nature of reflective practice being looked at, its importance is considered next.

The emerging guideline from the section on the nature of reflective practice is presented in Table 4.48.

Table 4.48: Emerging guideline from the nature of reflective practice: ERP_Lit4

ERP_Lit4: reflection	Systematic	Prioritise integrating reflection as part of daily practice.

Students can be empowered through reflection to make progress in their learning by making the right choices (Esterhuizen & Howatson-Jones, 2019). Educators assert that the emergence of reflective practice is part of a change that acknowledges the need for students to act and to think professionally as an integral part of learning throughout their courses of study (Helyer, 2015).

The information that has been reflected upon needs to be documented, and the next section examines the activity of learning to reflect.

4.4.2 Learning to reflect

According to Quinton and Smallbone (2010), students are empowered when they reflect on their learning achievements, and this enables them to make informed decisions about adjustments that are needed to make progress in their learning. This indicates a shift where the students are in charge of their learning in the sense that

they take an active role and do not wait to be told what to do. Exploring their understanding and their own responses can assist in learning by looking beyond normal actions (Helyer, 2015). This can include situations where students are asked to recognise what they did well, their mistakes, and what they could have done differently or where to improve (Section 3.8.3). The purpose of such questions is to help students to reflect on their actions and gain a better understanding so they can improve their practice and learning. The questions also assist the students in identifying strategies to learn effectively.

The guideline that emerged from this section on learning to reflect is presented in Table 4.49.

Table 4.49: Emerging guideline from learning to reflect: ERP_Lit5

ERP_Lit5: Reflection of the process	Document what went well, the mistakes, and what could have been done differently or where to improve.

Roldan *et al.* (2020) examined how HCI students use RP to reflect on their interactions with users. They developed grading standards for different stages. The students worked on a ten-week project that required them to develop a low-cost computer system for children in grades three through six. The results of the students' reflections indicated that they found it difficult to implement what they had learned in the literature about engaging with users. They recognised the importance of going above and beyond the call of duty when interacting with users. According to the study, the students remembered their interactions with the users rather than what happened. The researchers justify the students' actions by indicating that people cannot recall events as precisely as they occurred. The problem with the reflections from these students is that they did not recall their actions as they happened. This means that they reflected on their view of what they could recall. In other words, reflections are not always accurate. The guideline that emerged from this section on learning to reflect is presented in Table 4.50.

Table 4.50: Emerging guideline from the section on learning to reflect: ERP_Lit6

ERP_Lit6: Evaluation standards	Develop a rubric to guide the students on how they will be assessed and to facilitate evaluation standards.

The next section presents a learning environment that is conducive for the reflection process to take place.

4.4.3 Reflective writing

Various methods can be used to stimulate reflective practice: verbally, in writing, or by incorporating both (Padden-Denmead *et al.*, 2016). A common technique for encouraging students' reflection is reflective writing. Strategies for writing can take many forms, such as journals, reflective writings, or portfolios (Dubé & Ducharme, 2015). Allowing students to reflect on their experiences has been shown in several studies to improve the quality of their reflective writing.

The guideline that emerged from this section on reflective writing is presented in Table 4.51.

Table 4.51: Emerging guideline from the section on reflective writing: ERP_Lit7

ERP_Lit7: Stimulate reflection.	Use different strategies to prompt students to reflect on their work.

Reflection can help students gain a deeper understanding of some aspects of their experience and become better prepared for the future (Loughran, 2002). Quinton and Smallbone (2010) assert that reflecting and writing on practice allows practitioners to consider their own identities within the practice because they write and reflect on it. They also indicate that in this way, they become aware of thoughts, feelings, and reactions to different situations. Through their research, Xie *et al.* (2008) determined that students who maintained a journal were able to think more reflectively. Their results also revealed that students who showed a higher level of reflective thinking performed better academically. Even though the studies revealed the benefits of reflective writing, Chng (2018), after examining the literature,

discovered that students struggle to write reflective journals. The practice of asking students to write about their reflections has shown some benefits. For instance, students who participated in research conducted by Korucu-Kis and Kartal (2019) reported that reflective journaling improved their knowledge and performance.

Table 4.52 below presents the emerging guideline from this section on reflective writing.

Table 4.52 Emerging guideline on reflective writing: ERP_Lit8

ERP_Lit8: Reflective journal	Encourage students to maintain a reflective journal to become aware of their thoughts, feelings, and reactions to different situations.

Reflective journals have also been used in various undergraduate courses such as theology and media studies to demonstrate that their use is not limited to professional courses (Dubé & Ducharme, 2015). Among nursing students, scholars assert that it is a valuable tool that promotes active learning (Bruno & Dell'Aversana, 2017; Ruth-Sahd, 2003), improves experiential learning (Silvia *et al.*, 2013), and develops critical thinking and clinical reasoning skills (Thorpe, 2004). In higher education, it is used to monitor and develop reflective practice (Quinton & Smallbone, 2010).

To facilitate the process of reflective writing, students should be provided with at least one solid experience or series of experiences from which to draw and reflect in an organised and deliberate manner. As part of reflective writing, they also need to highlight what went well and the problems they encountered, as well as the improvements that need to be made (Schultz *et al.*, 2016). This set of results or activities allows them to apply their knowledge in future learning contexts (Johns, 2017). The outcomes of reflection consequently develop as a point of departure for subsequent planning and teaching (Quinton & Smallbone, 2010). In conclusion, incorporating the component of reflective writing for the students might improve the application of reflective practice.

From this section on reflective writing, the emerging guideline to allow students to document the events is presented in Table 4.53.

Table 4.53: Emerging guideline on reflective writing: ERP_Lit9

ERP_Lit9: Possible scenario	Provide students with a possible scenario that represents a solid experience or series of experiences to reflect upon.

The next section focuses on developing a learning environment that enables students to reflect, as the study is aimed at developing HCI students as reflective practitioners.

4.4.4 The learning environment for reflection

Some approaches can be applied to provide an environment that is conducive for learning reflection to enable students to adjust to a variety of settings. Such approaches are associated with reflection and how students learn. An environment that promotes ideas is developed by the reflection habit of students to persistently ask questions (Horton-Deutsch & Sherwood, 2017). Drawing from an extensive range of sources, Burton (2000) indicates that students who reflect on their learning are more likely to integrate theory with practice.

Students who take the opportunity to learn can potentially be in a position to succeed and for those who do not, the results could prove otherwise. This will be determined by the feedback that the student received during the assessment. In order to learn from mistakes, the students need appropriate feedback, which is even more important in HCI classes. Feedback that is meaningful and received on time is important to contribute toward active learning and it assists the students to engage with their learning (Hurtado *et al.*, 2018). According to Carter *et al.* (2018), good feedback can assist in learning during and after the experience. Likewise, Knott and Scragg (2016) note that being involved in reflecting on the feedback of the assessed work is a critical part of the student learning process. This means that to promote active learning, feedback should be received on time while the students are eager to receive it, and while the assessment information is still fresh in their minds. With this in mind, late feedback can discourage students from reflecting on the work because of the new information they are trying to understand or process. Attention is given to thinking about feedback received, but also doing something with the feedback to improve learning will make a difference in the students' learning process.

From the section on providing a learning environment for reflection, an emerging guideline is presented in Table 4.54.

Table 4.54: Emerging guideline from the section on learning environment for reflection: ERP_Lit10

ERP_Lit10: Feedback	Provide students with feedback as soon as possible to enable them to reflect on their assessed work and engage with their learning.

The next section discusses how reflective practice has been used in education as well as in different professions.

4.4.5 The role of reflective practice in education and other professions

There have been several studies about reflection in education. Reflection makes a significant contribution to the education field for students to review what they have learned for progressing and deep learning (Knott & Scragg, 2016). This means that students can improve their critical thinking skills. Chang (2019) noted that an important aspect in order for graduates to find employment is a need for continual learning as a means to adapt to changing situations. This is relevant to HCI students because they need to apply theory in practice. The adoption of reflective practice will assist students in learning through experience (Helyer, 2015).

The emerging guideline on the role of reflective practice in education and other professions is presented in Table 4.55.

Table 4.55: Emerging guideline on the role of reflective practice in education and other professions: ERP_Lit11

ERP_Lit11: Critical thinking	Help students analyse their work critically in terms of their own skills.
	assumptions and the assumptions of the methods used.

The necessity to prepare professionals as reflective practitioners has gained popularity among professionals (Harvey *et al.*, 2016). Education is required for

developing expertise and that includes the capability of reflecting consciously on one's practice (Larrivee, 2008). Reflection can help workers to critically evaluate what they have experienced in practice (Mamede & Schmidt, 2004). For one to grow and maintain competence throughout a lifetime of practice, one must learn effectively from their experiences (Helyer, 2015).

Reflection assists professionals in making effective decisions (Helyer, 2015); hence it has been widely embraced in learning and professional development in disciplines such as social work (Howatson-Jones, 2016), the healthcare profession (Thompson & Pascal, 2012; Watts, 2019), sports (Allan *et al.*, 2020; Cushion, 2018; de Schepper & Sotiriadou, 2018; Rodrigue & Trudel, 2018), and engineering (Bulman & Schutz, 2013). The emergence of RP can also be seen in nursing, where it became clearer how beneficial the practice would be for work-based students (Mann *et al.*, 2009). For example, Fragkos (2016) noted that for more than two decades, a growing body of literature has emphasised the relevance of RP in nursing. Therefore, RP is a practice that is embraced widely in the medical profession. Doctors' expertise is in high demand as medical knowledge grows and the healthcare delivery environment changes (Dubé & Ducharme, 2015). As a result, a variety of health professions, such as continuing, undergraduate, and postgraduate medical education include activities that promote reflection (Mamede & Schmidt, 2004). It is therefore regarded as a foundation for professional nursing practice (Miraglia & Asselin, 2015).

One thing that all the careers described in this section have in common is that they do not fit into the category of routine work, where you perform the same thing daily. From this perspective, being reflective gives one a broader perspective on a situation and allows one to think about how to enhance one's career in the future. As a result, the practitioner can consider prior experiences and gain knowledge and skills on how to improve in the future. In that way, a practitioner might develop different strategies for improvement.

The process of developing students' reflective skills is examined next.

4.4.6 Developing students' reflective skills

One of the significant learning objectives in higher education at present is to develop students' reflections on their learning (Hazzan, 2002). Engaging in reflection is seen

as a critical part of learning for higher education students and training in reflective skills needs to be incorporated into module content, to ensure that there are many chances to be involved with reflection and learning during their higher education learning (Sööt & Viskus, 2015). A study conducted by Johns (2017) also established that the process of teaching reflection should be integrated into the students' modules. Central to this thought is that reflection can be incorporated into HCI subjects by making it part of the study. Incorporating reflection in students' work is a method that can be applied to prompt them to reconsider and modify their initial responses (Brown *et al.*, 2018). Reflection and learning are substantiated by Jay and Johnson (2002) by highlighting how reflection is a process of becoming a practitioner who is periodically reflective and learns through their everyday experiences toward its recognition as a lived reality.

Table 4.56 below presents the emerging guideline from the section on developing students' reflective skills.

Table 4.56: Emerging guideline from the section on developing students' reflective skills: ERP_Lit12

ERP_Lit12: Module content	Assist students to learn to reflect by incorporating reflection into module content.

Reflection cannot be incorporated into students' learning without monitoring and supporting them. Johns (2017) points out that reflective practice requires monitoring and support to achieve its full learning potential. As a result of this study, Johns further looked at what must be done to move to a better position that is more consistent with accepting the needed practice. Also, the current syllabuses need to investigate different strategies for viably conveying curriculum objectives and meeting the students' expectations (Quinton & Smallbone, 2010). Alkhasawneh *et al.* (2008) argued that what is learned through reflection seems to be as important as reflection itself.

The emerging guideline from the section on developing students' reflective skills is presented in Table 4.57.

Table 4.57: Emerging guideline from the section on developing students' reflective skills: ERP_Lit13

ERP_Lit13: reflection	Monitoring	Integrating reflection into students' work in a way that make it possible to monitor that they engage in reflection.

According to Sööt and Viskus (2015), the use of reflective practice enables a correct understanding of the current context so that best practices can be implemented. The studies presented thus far provide evidence that RP is an important technique to be integrated into students' learning.

The study aims to develop the HCI students; hence the next section presents the reflective practitioner.

4.4.7 The reflective practitioner

A reflective practitioner continuously evolves and increases knowledge, allowing them to respond to classroom circumstances and specific student behaviours in a variety of ways (Larrivee, 2000). Also, being a reflective practitioner requires one to act as an observer by analysing one's work critically (Imel, 1992), surfacing one's understanding, and reflecting critically on new situations (Schön, 1983c). Critical reflection is an investigative process that fosters an awareness of our reflective circles and reveals our unexamined convictions, assumptions, and desires (Larrivee, 2000).

Reflective practice is used as a tool to improve practitioners' understanding of what they know and how they act. It is also regarded as a tool that is thought to enhance learning and knowledge in the workplace (Loughran, 2002). As a result, it allows for the advancement of knowledge gained by a practitioner through experience (Patil, 2013b).

According to Larrivee (2000), a reflective practitioner moves beyond basic understandings and skills to the point where they can adapt those skills to different situations, and finally to the point where new approaches are developed using those tools. In the author's opinion, reflective practitioners generally question beliefs and refine their practice as they go along, continuing to maintain a new perspective on

their practice and adapting their point of view as needed. A scientific discovery, a new insight, or possibilities are used to inform these conclusions. As stated by Farrell (2004), in order to make a good decision, reflective practitioners are willing to listen to more than one side of an issue instead of only considering their own. Therefore, developing knowledge of the practice setting and the ability to distinguish and respond to that knowledge enables a reflective practitioner to be open to the issues and concerns that are integral to shaping the practice (Loughran, 2002).

Research has shown that students reflect on what they did during class and how they can improve (Petsilas *et al.*, 2019). Therefore, reflective practitioners use experience and theory to direct and inform their practice (Esterhuizen & Howatson-Jones, 2019). This indicates a need to understand the role of RP not only in education but also in other fields to better understand its significance.

The emerging guideline based on the section on the reflective practitioner is presented in Table 4.58.

Table 4.58: Emerging guideline from the section on the reflective practitioner:
ERP_Lit14

ERP_Lit14: methods	Reflective	Develop specific skills to support various reflection strategies.

The next section presents the challenges that can hinder the reflection process.

4.4.8 Challenges to engaging in reflective practice

Many studies have reported on the challenges faced by students when reflecting (Chan & Lee, 2020; Chng, 2018; Zarestky & Bangerth, 2014) while other studies have demonstrated the advantages of using reflective practice (Section 4.4.5).

According to Chng (2018), students may be unsure of what to do during the reflection process regardless of how clear the reflective challenge and objective are. Chng (2018) also notes that failure to understand how to reflect on one's own experiences and think critically is not attributed to the student. The researcher believes that the 'proper' mind-set in traditional education that is fostered from childhood is that learning is connected with remembering accurate answers; errors

are associated with lower grades; and marks are prioritised over learning. The results demonstrated that being engaged in a system that values excellent grades above everything and regards information as invalid unless confirmed by using instruments such as the memorandum/rubric to mark, makes the concept of critical thinking foreign to the students as a natural outcome. This education system also makes it difficult for the students to “think out of the box” because of the way it has been designed.

However, this type of system is not used in all situations, e.g., in conservatory courses, academic accomplishment is not considered; as an alternative, performance is used for enrolment (Petsilas *et al.*, 2019). Conservatory courses involve training in musical instruments or a career performing as a musician (Casanova *et al.*, 2018). In conservatory studies, problems that are encountered regarding reflection in formal classes are also experienced. Petsilas *et al.* (2019) assert that the gap between practice and communication can be significant. They further emphasise that the move from experience to communication will entail adjusting or shaping one's thinking on what to write. In a case such as this, they suggest that the students should be exposed to a range of reflective strategies to access their bodily processes and achieve meaningful results. The authors support the view that this will aid in bridging the gap between personal experience and language communication. Moreover, they assert that innovative reflection approaches enable evaluative reasoning to be made more accessible in a variety of ways such as audio-visual, artistic, or bodily expression. Using reflective practice as a key teaching strategy does not guarantee better results in the studio or on stage. Based on this premise, they believe that for reflection to be effective in the academic realm, it must move the focus away from the outcome, which can be a piece of work on stage or an activity during class that allows students to observe themselves as practitioners.

In large classes, the challenges of applying reflective practice are also experienced. Korucu-Kis and Kartal (2019) used RP in their research because of the apparent theory-practice gap they observed in their classes. The module included RP as part of the curriculum, and students used journals for reflection every week. In their results, they discovered that students were unable to apply what they had learned in the classroom. The active participation of students was a barrier for them while

implementing RP, and they attributed it to the big number of students in the class. Because of the short time spent in class, not all students could engage in activities. Regardless of the outcomes, they believe that RP should be included in the educational curriculum to help students develop reflective abilities.

For students, reflecting on the feedback received may be challenging. For instance, Cook *et al.* (2020) noted the challenges that students have while reflecting on the feedback they received. They also noted that reflecting on feedback presents a chance to learn. Students from two separate universities who were doing a game design module were involved in the study. They were requested to participate in weekly team meetings and provide peer feedback. Researchers discovered that before participating in a team to share their experiences, students wanted to do self-reflection first. The motivations for starting with self-reflection were to make sense of the feedback and to improve their projects. The challenges that students encountered in reflecting on the feedback were identified as follows:

- Distinguishing significant feedback from insignificant feedback was difficult for them;
- The reflection approach they used did not facilitate the identification of valuable feedback since their goals differed; and
- Reflecting on feedback, they realized they needed to overcome underlying aspects that contribute to the challenges of the team.

Their findings suggest that students should be provided with assistance in identifying effective feedback, reflecting critically upon significant feedback, and setting up productive team environments. The researchers concluded the study by identifying “design guidelines for future systems to support reflection on peer feedback” (Cook *et al.*, 2020:1151).

According to Quinton and Smallbone (2010), reflection on written work can be stimulated by feedback. Their research found that incorporating reflection in a class setting may pose a challenge to students. The researchers affirm that in the majority of cases, students find it difficult to express their opinions and emotions when their assumptions and convictions are challenged. Based on the findings, controlled classroom settings can be a learning environment that enables students to develop skills for future work reflection.

The emerging guideline from the section on challenges to engaging in reflective practice is presented in Table 4.59.

Table 4.59: Emerging guideline from challenges to engaging in reflective practice: ERP_Lit15

ERP_Lit15: Feedback	Provide students with detailed feedback to assist them to reflect on their work.

Studies indicate that not all students will understand the purpose of reflection even if they are guided accordingly. Xie *et al.* (2008) in their study offered guidance to the students to arrange their reflections by journaling. Several students were uncertain about the definition of reflection, how it could benefit their academic pursuits, and how to effectively incorporate it into their studies. The authors found that many students simply remembered their learning or how the instructor delivered the class. They noted that the findings were not unexpected, given that students spend the majority of their time attending lectures and studying. The study demonstrates that the students, on the other hand, could at least relate to what had been taught, even if they did not understand the main focus of reflection.

A possible challenge may be the lack of guidelines on how to incorporate RP into studies. The study conducted by Thomas and Volschenk (2021) in South Africa demonstrated that one hindrance to the practical application of RP is a lack of participation by students in reflective learning. Their results revealed that clear guidelines on how to incorporate RP into the learning programme could help improve the use of RP.

The emerging guideline from the section on challenges to engaging in reflective practice is presented in Table 4.60.

Table 4.60: Emerging guideline from challenges to engaging in reflective practice: ERP_Lit16

ERP_Lit16: Reflective guidelines	Provide students with guidance on how to reflect on their studies.

Table 4.61 presents the summary of the guidelines that were formulated from A in the FMA section.

Table 4.61: Summary of the activities of RP guidelines from literature

ERP_Lit1: Review evidence	Use various reflective practice activities to review the evidence and possible action to take.
ERP_Lit2: Theory-practice gap	Use reflective practice to develop knowledge from experience.
ERP_Lit3: Reflecting on the experience	Allow students to make appropriate decisions by drawing from past experiences about the action they must take.
ERP_Lit4: Systematic reflection	Prioritise integration of reflection as part of daily practice.
ERP_Lit5: Reflection of the process	Document what went well, the mistakes, and what could have been done differently or where to improve.
ERP_Lit6: Evaluation standards	Develop a rubric to guide the students on how they will be assessed and to facilitate evaluation standards.
ERP_Lit7: Stimulate reflection.	Use different strategies to prompt students to reflect on their work.
ERP_Lit8: Reflective journal.	Encourage students to maintain a reflective journal to become aware of their thoughts, feelings, and reactions to different situations.
ERP_Lit9: Possible scenario	Provide students with a possible scenario that represents a solid experience or series of experiences to reflect upon.
ERP_Lit10: Feedback	Provide students with feedback as soon as possible to enable them to reflect on their assessed work and engage with their learning.
ERP_Lit11: Critical thinking skills	Help students analyse their work critically in terms of their own assumptions and the assumptions of the methods used.
ERP_Lit12: Module content	Assist students to learn to reflect by incorporating reflection into module content.
ERP_Lit13: Monitoring reflection	Integrating reflection into students' work in a way that makes it possible to monitor that they engage in reflection.
ERP_Lit14: Reflective methods	Develop specific skills to support various reflection strategies.

ERP_Lit15: Feedback	Provide students with detailed feedback to assist them to reflect on their work.
ERP_Lit16: Reflective guidelines	Provide students with guidance on how to reflect on their studies.

The next section presents how RP-enriched guidelines can be used to address the challenges experienced during the reflective process and to guide the study.

4.5 Reflective Practice guidelines from literature

The guidelines identified from the literature study are presented in Table 4.62. Code RP_G is used to represent RP guidelines. The guidelines are mapped with other guidelines that represent the same idea.

Table 4.62: RP guidelines from literature

Guideline code	Related topic	Guideline	Reference
RP_G1	Experiential learning	Promote the completion of a new task that will allow the students to construct their knowledge when they apply theoretical content to a specific situation.	Dewey1; Kolb2; Kolb5; RP_Lit9; Zwodiak1
RP_G2	Reflective practice strategy	Integrate reflective practice as a strategy into students' learning to assist them in completing the work and how to improve their learning.	RP_Def1; RP_Def3; Zwodiak9
RP_G3	Critical skills	Encourage students to critically examine their own assumptions and those of the methods they chose.	Lawrence1; RP_Lit11
RP_G4	Description of the event	Ask students to reflect on one event by describing their perceptions and not to make any judgments at this stage.	Gibbs1; Rolfe1
RP_G5	Decision making	Promote effective decision-making and justification for a specific process.	Dewey2; Schön; Schön5; Gibbs4;

Guideline code	Related topic	Guideline	Reference
			Gibbs5; Gibbs6; RP_Def2; RP_Lit7; RP_Lit14; Zwodiak5; Zwodiak6
RP_G6	Reflecting on the process	Document what went well, and the challenges experienced that will need to be addressed in decision-making processes.	Schön4; Gibbs2; Gibbs3; Kolb3; Rolfe2; Rolfe3; RP_Lit1; RP_Lit3; RP_Lit5; Zwodiak4; McCoach1
RP_G7	Monitoring reflection	Integrate reflection into students' work in a way that makes it possible to monitor that they engage in reflection.	RP_Lit13
RP_G8	Detailed feedback	Provide students with detailed feedback quickly to enable them to reflect on their assessed work and to make changes for further action.	RP_Lit10; RP_Lit15
RP_G9	Reflective guidelines	Provide students with guidance on how to reflect on their studies.	RP_Lit16
RP_G10	Linking theory with practice	Ask students to evaluate what they have learned through practice.	Kolb1; Zwodiak3; RP_Lit2
RP_G11	Prior knowledge	Assist students in reflecting on their experiences in terms of their prior knowledge and knowledge gaps by adding reflection as a key process in their learning cycle.	Dewey5; Schön1; Lawrence2; Schön2; ERTL_Lit1; RP_Lit4; RP_Lit12; Kolb4
RP_G12	External factors	Consider factors that influence individuals and practices outside of the practice domain.	Dewey3; McCoach3
RP_G13	Evaluation standards	Develop a rubric to guide the students on how they will be assessed and to facilitate evaluation standards.	RP_Lit6

Guideline code	Related topic	Guideline	Reference
RP_G14	Maximise students' potential learning	Customise learning by applying different strategies when teaching to accommodate individual needs.	Zwodiak7; RP_Lit7
RP_G15	Reflective Journal	Encourage students to maintain a reflective journal to become aware of their thoughts, feelings, and reactions to different situations.	RP_Lit8
RP_G16	Evaluate own teaching	Use feedback from formative evaluation in the classroom to make adjustments for further action.	Dewey4; Zwodiak2; McCoach2
RP_G17	Enhance teaching quality	Reflect on lesson outcomes and acquire a variety of knowledge bases and models for teaching.	Zwodiak8
RP_G18	Reflective skills	Develop specific skills to support various reflection strategies.	RP_Def2; RP_Lit7; Schön5; Gibbs6; RP_Lit14; Zwodiak6
RP_G19	Problem-solving skills	Develop a set of basic skills in order to suggest possible solutions from various perspectives.	Dewey2; Gibbs4; Zwodiak5; Schön3
RP_G20	Reflecting on learning	Inspire students to add reflection as a key process in their learning cycle.	Schön2; ERTL_Lit1; RP_Lit4; RP_Lit12; Kolb4

The guidelines derived from the literature was used to guide the first action research cycle. The next section presents the summary of the chapter.

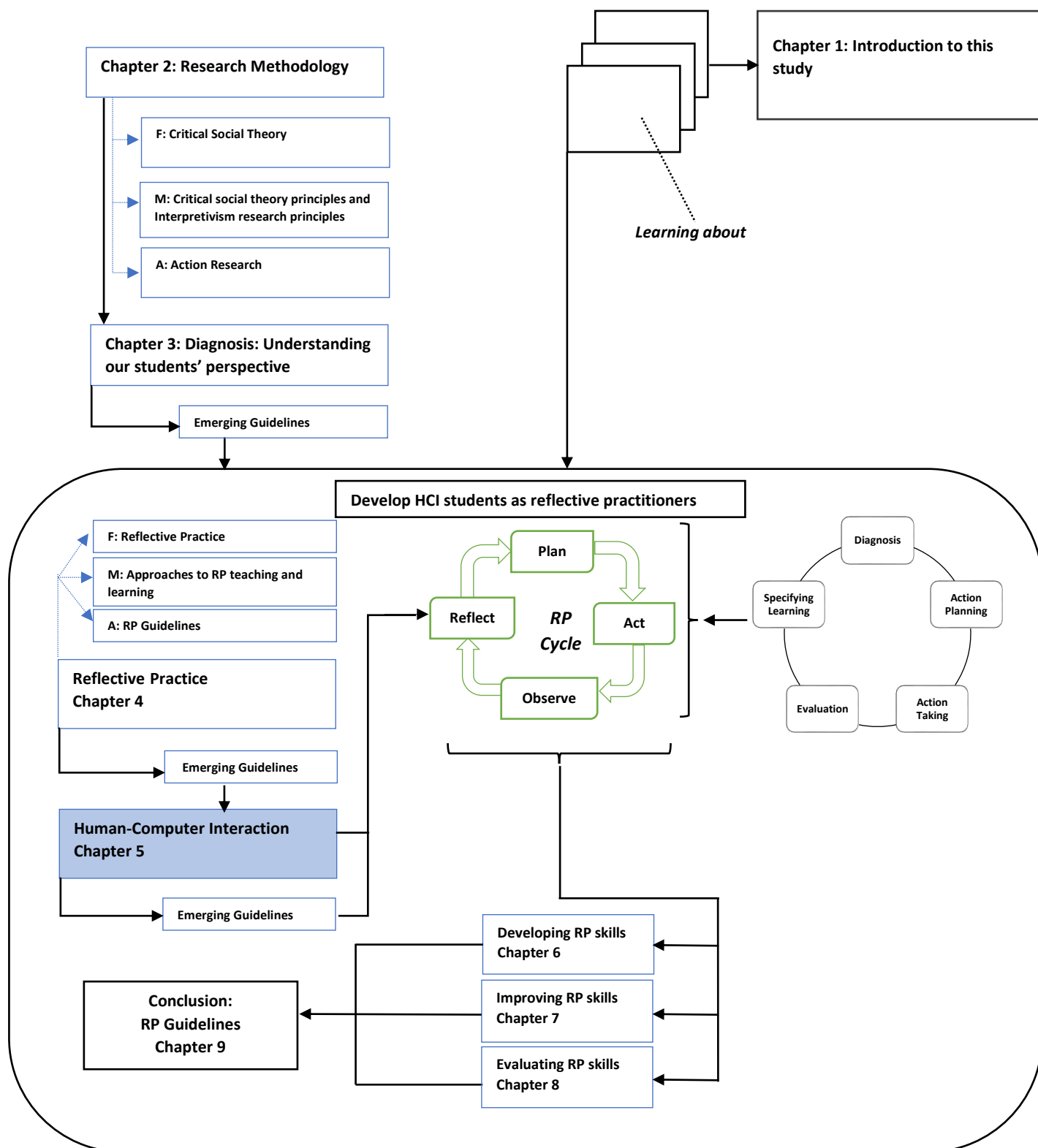
4.6 Chapter summary

This chapter gave an overview of current research and discussions on the application of RP as a framework of ideas to formulate guidelines for developing students as reflective practitioners. The definition and historical background of RP

were presented. The works of John Dewey and Donald Schön were discussed and the importance of each was highlighted. The role of RP in education and other professions was discussed. Literature has shown that professionals who reflect on their decisions are more likely to make informed decisions.

Different reflective writing approaches were discussed. The literature revealed that students who demonstrated a greater level of reflective thinking outperformed their classmates in terms of grades. The process of reflection is a challenge for many students. A discussion on challenges that prevent the reflection process revealed that the education system makes it difficult for students to be creative. This is influenced by the way the assessments are designed. Several intervention strategies were presented that might be employed to motivate students to use RP. The lack of guidelines to improve the implementation of RP was also highlighted.

Learning is an active process and students can learn to reflect. They can make informed decisions about the adjustments that are needed to make progress in their learning. The chapter concluded with guidelines that can be used to develop students' reflective skills.



CHAPTER 5: HUMAN-COMPUTER INTERACTION

5.1 Introduction

The primary objective of this study is to formulate guidelines for developing human-computer interaction (HCI) students as reflective practitioners. In order to accomplish this, HCI as a framework of ideas (FMA) was employed to achieve the outcome of developing HCI students as reflective practitioners. The FMA model for this chapter is shown in Figure 5.1.

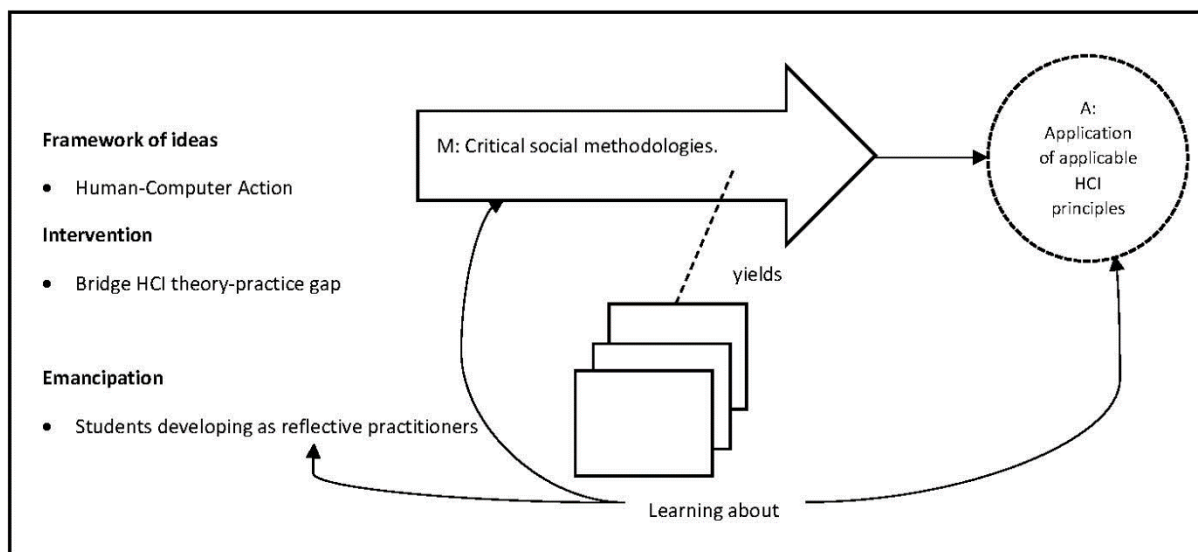


Figure 5.1: Elements of the study depicting HCI (F)

Among the most common viewpoints about HCI is that there is a gap between HCI theory and its application (Beck & Ekbja, 2018; Remy *et al.*, 2015; Velt *et al.*, 2020). In an attempt to bridge the HCI theory-practice gap perceived in HCI classes, a literature review was conducted, starting with the definitions of HCI in Section 5.2. This chapter aims to gain a better understanding of current knowledge and discussions on the topic. The history of HCI is provided in Section 5.3 to provide background information about the subject. HCI in academia is discussed in Section 5.4. Fields that contribute to the HCI field are presented in Section 5.5. The goals of HCI to provide users with the best possible experience are discussed in Section 5.6. The principles of HCI devised to meet the needs of system users when designing the system are addressed in Section 5.7. Section 5.8 presents global perspectives and African experiences on the practice of HCI, and the topics addressed in different

countries. The challenges experienced in HCI classes are discussed in Section 5.9. Section 5.10 presents how HCI classes are conducted from different perspectives.

The next section presents the definitions of HCI found in the literature.

5.2 Human-Computer Interaction definitions

Human-computer interaction did not have a commonly agreed-upon definition of the topics that make up the field when Association for Computing Machinery's (ACM's) Special Interest Group on Computer-Human Interaction (SIGCHI) developed a definition that encompasses what needs to be taught as follows:

“Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them” (Hewett et al., 1992:5).

The definition provided by the SIGCHI is often cited by scholars including Abe (2021); Akiyama (2021); Bibri (2021); Carta and Boratto (2016); Errity (2016); Ghanbari et al. (2017); Guney (2019:732); Magnaudet et al. (2019). Currently, this definition is widely accepted (Abe, 2021). Most definitions of HCI focus on studying, developing, and implementing the interactions between users and computers (Bibri, 2021). Jose et al. (2014) argued that any machine that cannot be operated by humans is useless. This implies that there should be some form of interaction between humans and computers.

In 1998, the authors of *“The occupational ergonomics handbook”* had a different view on the acceptance of a single definition, noting that although HCI is a common term, it is not defined properly (Karwowski & Marras, 1998). They indicated that the reason for the lack of an accepted definition is the rapid evolution of HCI over time. HCI has gone from text-based systems to graphical user interface, and then to voice user interfaces (O'Regan, 2021). HCI was also defined as follows:

“Human-computer interaction (HCI) is the study of interaction between people (user) and computers” (Ritter et al., 2014:45).

“HCI is a cross-disciplinary area (e.g., engineering, psychology, ergonomics, design) that deals with the theory, design, implementation, and evaluation of

the ways that humans use and interact with computing devices” (Kim, 2015:1).

“Human-computer interaction (HCI) is a combining field of study of human interactions and intelligent computing. It is combined for focusing on computer technology design and the interaction between humans (i.e., users) and computers” (Saad & Mohamed, 2021:1).

“HCI, also called human-machine interaction (HMI), refers to the interfaces between computer technology and people as users” (Katona, 2021:3).

“Human-computer interaction (HCI) is traditionally known as the discipline of studying the design, implementation, and evaluation of humans’ interaction with computers, computing devices, and technology in general” (Mubin et al., 2022:1).

These definitions support the summary provided by Bibri (2021). All definitions provided for HCI mention the interactions that occur between humans and computers. This involves communication through a computer interface with the user (Kovalchick & Dawson, 2004). The study of how people, called users, interact with computers is called HCI (Cruz-Benito et al., 2019; Kovalchick & Dawson, 2004; Yun et al., 2021). In particular, HCI is interested in determining how humans relate to emerging technologies.

The next section presents the history of HCI.

5.3 History of Human-Computer Interaction

The history of HCI can be traced back to the 1950s and the 1960s (Fitzpatrick, 2018; Gurcan et al., 2021), shortly after the introduction of electronic computers (McCracken et al., 2004). The first HCI paper was published in the late 1950s (Dix, 2017; Gurcan et al., 2021; Shackel, 2009). The aim of this 1950s study was to improve the ergonomic aspects of electronic machine design (Shackel, 1959). This study examined how to avoid operator mistakes on an analogue computer. Ergonomics is important in the field of HCI because in-depth research on users is conducted through the application of ergonomics (Zhu, 2020). Ergonomics is described as the study of people's interactions with their surroundings (Benyon,

2014). More recently, studies offering contradictory findings regarding the history and role of ergonomics have emerged. Hussein *et al.* (2019) draw on an extensive range of sources to demonstrate that ergonomics dates back to the 1850s. The authors indicate that ergonomics has been used in various fields, such as the military, academia, and aviation. Research to enhance computer usability has been funded by the United States Military since the mid-1950s, when different institutions followed ergonomic principles (Hernández-Ramírez, 2019). Brian Shackel (1927–2007) from the United Kingdom also published a research paper titled "*Ergonomics in the design of a large digital computer console*" in 1962 which at the time was the world's largest computer (Jacko, 2012).

Personal computers began to appear in the market in the late 1970s (Abe, 2021). During the mid/late 1970s, information technology professionals were the only people who interacted with computers (O'Regan, 2021). In the 1970s and the early 1980s, computers became affordable and smaller (Judge, 2020; McCracken *et al.*, 2004; van der Stelt, 2021). People have begun to buy them for personal use (Batty, 2021). As a result, there was a need to accommodate the different needs of these people. Thus, software and computer producers have considered designing "*user-friendly*" products (Gurcan *et al.*, 2021; McCracken *et al.*, 2004).

This diffusion of computers has triggered the development of HCI as a discipline and community (Bhosale *et al.*, 2021; Dix, 2017; Gaines, 2019; Hernández-Ramírez, 2019; Zhu, 2020). Dix (2017) noted that, despite the emergence of HCI in the 1980s, its origins could be tracked to at least 25 years earlier.

The 1980s also witnessed the emergence of new interaction styles based on graphical user interfaces, which challenged many Computer Science students and professionals to create simple and intuitive interfaces for computer systems (MacKenzie, 2012). At that time, the letter "I" in HCI represented both the interface and interaction (Gurcan *et al.*, 2021). The human-computer interface entails an interface design that facilitates easy interaction between users and computers in a pleasant manner (Dubey *et al.*, 2014). Although several ground-breaking designs were developed during the 1980s and the 1990s, Apple Macintosh and Windows eventually became the leading brands of operating systems (Benyon, 2019). Since

the 1990s, the "I" in HCI has evolved from "interface" to "interaction" because digital technologies have grown exponentially (Hinze-Hoare, 2007).

The HCI shifted its focus to embracing a broader view of the quality of interactive products in the late 1990s (Diefenbach *et al.*, 2014). At that stage, the aim was to develop interactive designs for groups and individuals in different contexts: at home, at work, in the classroom, or on the go using a mobile application (Hollender *et al.*, 2010). The availability of mobile phones in the late 1990s also supported the transfer of interactive computers to portable devices with internet access and the ability to make calls from anywhere (Gaines, 2019). Internet access has a significant impact on how online communication occurs (Gurcan *et al.*, 2021).

Microsoft chief executive officer, Bill Gates, anticipated in his keynote address at the Consumer Electronics Show held in 2008 in Las Vegas, that HCI would undergo a significant shift in the coming years by stressing the importance of natural user interfaces (Ren & Bao, 2020).

According to MacKenzie (2012), the evolution of computers makes the HCI an interesting field. HCI is now in a new era of globalisation (Grudin, 2021). As the next generation of interactive technologies continues to advance, natural HCI technologies are expected to be at the forefront (Ren & Bao, 2020). Research conducted by Bhosale *et al.* (2021) predicted that in the coming years, computer usage would gradually shift away from desktops toward smartphones owing to technological advancements such as the web system. According to Bhosale *et al.* (2021), HCI is expected to become a global research topic. The next section presents the application of HCI in academia.

5.4 HCI in academia

HCI emerged as a field of study in the early 1980s (Benyon, 2019). As an emerging field, universities recognised the importance of incorporating HCI or user interface design into the curriculum in the early 1980s (MacKenzie, 2012). HCI concepts and philosophies borrowed from ergonomics have been used in universities (Waterson & Eason, 2009).

Several textbooks and coherent curricula emerged in the early 1990s (Benyon, 2019). Guimarães and Prates (2018) stated that in the 1990s, HCI guidelines for national and international curricula were recommended. National guidelines are more topic-specific than international guidelines, which provide a list of topics and learning outcomes (Guimarães & Prates, 2018). In addition, curriculum-specific guidelines also exist. Curriculum guidelines require both theoretical and practical knowledge (Pittarello & Pellegrini, 2017). An early curriculum development initiative in 1992 included illustrations of modules and module outlines for undergraduate programs in information systems and computer science along with a detailed definition of HCI (St-Cyr *et al.*, 2018).

According to Abdelnour-Nocera *et al.* (2012), university courses in human-computer interaction can now be found all around the world, outside of native cultures. The authors also mentioned that initially, the emphasis of the research was to ensure that the interface was of high quality, effective, and efficient.

Creating a useful and satisfying HCI system requires interdisciplinary knowledge and skills in the fields of engineering, computer science, and design (Kuo *et al.*, 2019). Methods to improve interface usability and learnability, ways to evaluate interface performance, new ways to interact, approaches to developing design methodologies and applying them to real-world problems, and creating prototypes for new systems are all considered to be part of HCI (Bibri, 2021).

The problem that has been experienced in HCI classes is that practical work is not assigned much time to bridge the perceived theory-practice gap (Pittarello & Pellegrini, 2017). Harrison (2018) argued that scholars could conduct research for the next project by disregarding practical concerns or putting them aside. This creates a gap between the theory and practice. The emerging guideline from the HCI in academia section is presented in Table 5.1. The code HCI_ACA is used to represent emerging HCI literature guidelines from academia.

Table 5.1: Emerging guideline from the section on HCI in academia - HCI_ ACA1

HCI_ACA1: Practical work	Allocate time for practical work.

Considering its multidisciplinary nature and rapid technological advancement, HCI is difficult to study (Vasilchenko *et al.*, 2018). A critical aspect of HCI education is the exploration, understanding, and improvement of the usability and user experience of interactive systems and products (Abdelnour-Nocera *et al.*, 2012). Consequently, universities are increasingly teaching more about HCI (Abdelnour-Nocera *et al.*, 2017). The guideline that emerged from the HCI in academia section is presented in Table 5.2.

Table 5.2: Emerging guideline from the section on HCI in academia- HCI_ ACA2

HCI_ACA2: User experience	Emphasise the importance of usability and user experience to students.

Collazos and Merchan (2015), in their research, discovered that out of the top 10 universities in Columbia, there was only one university that offered HCI. Their research focused on bridging the theory-practice gap between what is taught at the university and what is happening in the industry. They discovered that people working in the software industry are not knowledgeable about HCI; hence, what is taught at the university is not applied. According to their findings, the most common teaching method is to assign students a case study in which they can apply theory learned in class. Table 5.3 presents the guideline that emerged from this section on HCI in academia.

Table 5.3: Emerging guidelines from HCI in academia– HCI_ ACA3

HCI_ACA3: Teaching HCI	Assign a case study based on theory work.

A summary of the guidelines that emerged from this section is presented in Table 5.4.

**Table 5.4: Summary of the emerging guideline from the section on HCI in academia-
HCI_ACA**

HCI_ACA1: Practical work	Allocate time for practical work.
HCI_ACA2: User experience	Emphasise the importance of usability and user experience to students.
HCI_ACA3: Teaching HCI	Assign a case study based on theory work.

The next section presents the fields that contribute to the HCI.

5.5 Fields that contribute to HCI

HCI is a multidisciplinary field that focuses on the human aspects of computer technology development (Mubin *et al.*, 2022; Müller *et al.*, 2011). HCI is rapidly expanding as a multidisciplinary field, enabling advances in various fields that have direct implications for humans (Lee, 2019). The scope of the HCI field is broad (MacKenzie, 2012) because it combines many disciplines such as computer vision, artificial intelligence, motion tracking, and face recognition (Acuna *et al.*, 2012; Collazos & Merchan, 2015). In their research, Terblanche and Goede (2014) noted HCI as a discipline within Information Systems.

Various fields of study have contributed to HCI methodologies and theories (Good & Omisade, 2019). O'Regan (2021) pointed out that HCI integrates cognitive psychology, computer science, communication, and design. Among the academic disciplines that the HCI field draws from are computer science, cognitive psychology, sociology, business, anthropology, ergonomics, and industrial design (Arnett, 2006). Figure 5.2 indicates the interdisciplinary nature of HCI.

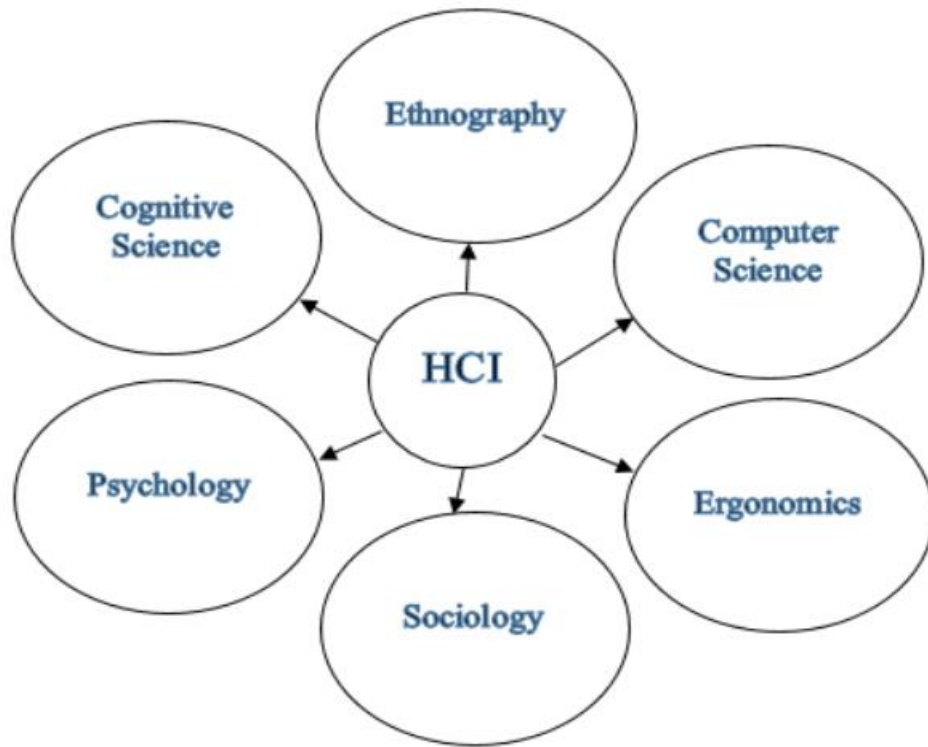


Figure 5.2: The interdisciplinary field of HCI (Good & Omisade, 2019)

Coiera (2015) affirmed that, in HCI, psychology and design principles that govern human interactions with computer systems are analysed. In order to establish the role of psychology in HCI, Card *et al.* (2018) maintained that psychological knowledge must be applied to create better interfaces.

The next section presents the goals of HCI.

5.6 Goals of HCI

The goals of HCI are “*safety, utility, effectiveness, efficiency, and usability*” (Diaper & Sanger, 2006:119; Dubey *et al.*, 2014:3213; Hinze-Hoare, 2007:1). O'Regan (2021) suggested that HCI requires the knowledge of computers and humans. Researchers have found several advantages in incorporating HCI concepts into their designs. These advantages include useable system designs (Razzak & Islam, 2020), ease of use (Alrizq *et al.*, 2022), ease of learning (Khan & Rana, 2021), and the implementation of interactive systems (Palanque & Martinie, 2021). According to Terblanche (2014), it is the goal of HCI to provide users with the best possible

experience. Regardless of their goals, users should be able to accomplish their goals using interfaces (Pérez-Marín *et al.*, 2022).

Usability is considered to be a critical factor in HCI. The goal is to develop software and technology that people will find useful in their everyday lives and that they want to use, and can use (Alao *et al.*, 2019). Collazos and Merchan (2015) noted that the usability of a software product has a significant impact on its success. They also mentioned that user involvement during the development stage played an important role in terms of product usability. Kim (2015) uses the term “high usability” to refer to interfaces that achieve the following: ease of use, efficiency, safety, and successful task completion. In HCI, usability includes features that are pleasing to the eye and senses, appealing to the brain, efficient, effective, and safe (Kabanda, 2019). Müller *et al.* (2011) highlighted *the evaluation of the interface* as an important aspect.

According to De Wet (2021), a practical assignment in HCI can provide students with an opportunity to conduct usability evaluations even with limited resources or access to advanced technology. The guidelines that have emerged from this segment are presented in Table 5.5. Code HCI_G is used to represent the emerging guidelines from the HCI goals.

Table 5.5: Emerging guidelines from goals of HCI - HCI_Goal1

HCI_GL1: Involve users	Involve users during the design of the system.
HCI_GL2: Evaluate interface	Provide the students with the opportunity to conduct usability tests on the interface.

Safety comprises the safety of users and data (McCracken *et al.*, 2004). Keeping the user safe means keeping them away from dangerous and unwanted conditions (Preece *et al.*, 2015). When referring to safety, correct task execution is required (Diaper & Stanton, 2003) to avoid undesirable situations. Therefore, users’ work should be protected from sabotage, unintentional intervention, and modification by others (Hinze-Hoare, 2007).

Another goal, utility, is relevant to the functions provided by a system that allows users to accomplish their tasks (Preece *et al.*, 2015). Effectiveness depicts how well a system performs its function, whereas efficiency refers to how a system aids a user in doing his or her work (Preece *et al.*, 2015). With the goal of efficiency when using the system, users can accomplish their goals as quickly as possible (McCracken *et al.*, 2004). The guideline that emerged from this segment on HCI goals is presented in Table 5.6.

Table 5.6: Emerging guideline from goals of HCI - HCI_ G3

HCI_GL3: HCI goals	Incorporate HCI goals in every user interface design.

A summary of the guidelines that emerged in the section on goals of HCI is presented in Table 5.7.

Table 5.7: Summary of emerging guidelines - HCI_ GL

HCI_GL1: Involve users	Involve users during the design of the system.
HCI_GL2: Evaluate interface	Provide the students with the opportunity to conduct usability tests on the interface.
HCI_GL3: HCI goals	Incorporate HCI goals in every user interface design.

The next section presents the principles applied in the field of HCI.

5.7 Principles of HCI

It is critical to recognise that good HCI design is typically difficult, owing to the fact that it is a multidisciplinary field that requires simultaneously considering many factors. These factors include the types of users, tasks, capabilities, and costs of the devices as well as the lack of objective or exact quantitative evaluation measures (Kim, 2015). These principles are general design guidelines with broad applications and limited specificity (Dix *et al.*, 2003). They are used to ensure that the design promotes the best user experience and is user-centred (Terblanche, 2014). In addition to providing a guide for the designer during the design process, design

principles can also be used to assess and criticise prototype design ideas (Benyon, 2014). The principles of HCI are, “*knowing the user, understanding the task, reducing memory load, striving for consistency, reminding the users to refresh their memory, preventing errors or reversal of action and naturalness*” (Ismail, 2019:1412). Table 5.8 provides the principles of HCI as well as a short description of each.

Table 5.8: Principles of HCI

Principle	Description
Know the user	There is a need to know and have information about the intended users of the system. Therefore, this principle emphasises the importance of providing an interface and interaction that caters to the needs of the user the system is being designed for (Kim, 2015).
Understand the task	The designers of the system need to understand what the user will need to accomplish when using the system (Kim, 2015).
Reduce memory load	To keep the user engaged, information must not need to be remembered from one task to the next (Hinze-Hoare, 2007).
Strive for consistency	There should be consistency in layout aesthetics, typefaces, and colours in good design (Purbasari <i>et al.</i> , 2021).
Remind users and refresh their memory	Users must reload the original task's context into their working memory when they return to the task they left behind (Jin & Dabbish, 2009). Therefore, remind the user of their previous task and provide links back to it when their task has been interrupted, as well as remind them of what they were working on at the time of the notification (Horvitz, 2001; Schneegass & Draxler, 2021).
Enhance the error message interface	Deals with helping reduce the loss of productivity due to errors (Shneiderman <i>et al.</i> , 2016). Users need to be able to understand these in a way that identifies the problem and suggests a solution in a straightforward manner (Dubey <i>et al.</i> , 2014; Hinze-Hoare, 2007).
Naturalness	Avoid providing any irrelevant information (Dubey <i>et al.</i> , 2014).

HCI principles are crucial for creating an interface. According to Al Mahdi *et al.* (2019), in order to design an interface that meets the needs of system users, it is

essential to adhere to all HCI principles. The guideline that emerged from this segment is a generic guideline that incorporates all the principles presented in this section. The emerging guideline is presented in Table 5.9. Code HCI_PR is used to represent emerging guideline from HCI principles.

Table 5.9: Emerging guideline from principles of HCI- HCI_PR1

HCI_PR1: HCI principles.	Assist students to use appropriate HCI principles for the current context in their designs to optimize the user experience.

Over the years, scholars have developed the design principles presented below. The principles presented cover an extensive range of areas. Section 5.7.1 presents the principles of design for usability. Universal design principles, also referred to as usability heuristics, are presented in Section 5.7.2. Section 5.7.3 presents principles that support and promote usability for an interactive system design. This is followed by the principles of user interface design presented in Section 5.7.4. A comprehensive set of guidelines for designing effective user interfaces derived from different authors is presented in Section 5.7.5. The principles that specifically focus on the user interface design are described.

5.7.1 Principles to design for usability

Gould and Lewis (1985) recommended key principles to design for usability. They affirmed that to create a computer system that is both useful and easy to use they believe that three system design principles should be followed. The principles are presented in Table 5.10.

Table 5.10: Three key principles to design for usability (Gould & Lewis, 1985)

Principle	Description
Early focus on users and tasks	It is important for designers to first identify who their users was. This is done by studying the nature of what they will have to do.
Empirical measurement	Users' actual performance and reactions should be recorded, observed, and analysed early in the development process using simulations and prototypes.
Iterative design	When problems arise during user testing, they must be addressed.

Gould and Lewis (1985) further stated that people should be able to learn and remember any system designed for their use; that is, it needs to be user-friendly and contain the features they need in their work. They concluded that usability ratings would be much higher if the systems were designed according to the three principles mentioned above. Several criticisms have also been discussed, including confusion regarding similar but different ideas, miscalculation of the value of user interaction, and competing approaches. Benyon (2014) also indicated that these principles were not supported by everyone because they were regarded as too broad and abstract, making them difficult to use in the design process.

The guideline that emerged from the section on principles to design for usability is presented in Table 5.11. The code HCI_PRIN is used to represent emerging guideline for HCI principle.

Table 5.11: Emerging guideline from the section on principles to design for usability – HCI_PRIN1

HCI_PRIN1: Usability design principles	Take advantage of usability design principles to create a computer system that is both useful and easy to use

5.7.2 Universal design principles

Universal design principles were created to guide a variety of design disciplines, such as environments, products, and communications (Duncan, 2006). They were also developed to provide a set of guidelines for designing user interfaces and products that are accessible to all users, regardless of their abilities or disabilities. The principles are presented in Table 5.12.

Table 5.12: Principles of universal design (Benyon, 2014; Dix *et al.*, 2003; Duncan, 2006; Persson *et al.*, 2015)

Principle	Description
Equitable use	The design does not disadvantage or stigmatize any group of users.
Flexibility in use	The design accommodates a wide range of individual preferences and abilities.
Simple, intuitive use	The use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
Perceptible information	The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
Tolerance for error	The design minimises hazards and the adverse consequences of accidental or unintended actions.
Low physical effort	The design can be used efficiently and comfortably and with minimum fatigue.
Size and space for approach and use	Appropriate size and space are provided for approach, reach, manipulation, and use, regardless of the user's body size, posture, or mobility.

Heuristics were later analysed to provide the most comprehensive explanation (Nielsen, 1994). Among the key findings is that usability heuristics can be improved

further by adding additional principles and measuring the effectiveness of heuristics in addressing user needs. A new set of nine heuristics was developed, as follows:

“Visibility of system status, match between system and the real world, user control and freedom, consistency and standards, error prevention, recognition rather than recall, flexibility and efficiency of use, aesthetic and minimalist design, and helping users recognize, diagnose, and recover from errors” (Nielsen, 1994:152).

A further recommendation in this paper was to test for heuristics' applicability within the design context and to adjust them accordingly to meet the specific needs and objectives of the project.

The guideline that emerged from the section on universal design principles is presented in Table 5.13.

Table 5.13: Emerging guideline from the section on universal design principles – HCI_PRIN2

HCI_PRIN2: Universal design principles	Make use of a set of guidelines for designing user interfaces and products that are accessible to all users, regardless of their abilities or disabilities.

5.7.3 Principles to support usability

The applicable principles that support and promote usability for interactive system design as specified by Dix *et al.* (2003) are presented in Table 5.14.

Table 5.14: Principles to support usability by Dix *et al.* (2003)

Learnability	
Predictability	Support for the user to determine the effect of future action based on past interaction history
Synthesizability	Support for the user to assess the effect of past operations on the current

Learnability	
	state
Familiarity	The extent to which a user's knowledge and experience in other real-world or computer-based domains can be applied when interacting with a new system
Generalisability	Support for the user to extend knowledge of specific interaction within and across applications to other similar situations
Consistency	Likeness of input–output behaviour arising from similar situations or similar task objectives
Flexibility	
Dialogue initiative	Allowing the user freedom from artificial constraints on the input dialogue imposed by the system
Multi-threading	The ability of the system to support user interaction pertaining to more than one task at a time
Task migratability	The ability to pass a control for the execution of a given task so that it becomes either internalized by the user or the system or shared between them
Substitutivity	Allowing equivalent values of input and output to be arbitrarily substituted for each other
Customizability	Modifiability of the user interface by the user or the system
Robustness	
Observability	The ability of the user to evaluate the internal state of the system from its perceivable representation
Recoverability	The ability of the user to take corrective action once an error has been recognised
Responsiveness	How the user perceives the rate of communication with the system
Task conformance	The degree to which the system services support all of the tasks the user wishes to perform and in the way that the user understands them

The guideline that emerged from the section on principles to support usability is presented in Table 5.15.

Table 5.15: Emerging guideline from the section on principles to support usability – HCI_PRIN3

HCI_PRIN3: HCI usability support principles	Use applicable principles that support and promote usability for an interactive system design.

The next section presents the design principles.

5.7.4 Design principles

Benyon (2014) put together 12 design principles derived from authors such as Norman, Nielsen and Dix to provide a comprehensive set of guidelines for designing effective user interfaces. The principles are presented in Table 5.16.

Table 5.16: Design principles Benyon (2014:86)

Learnability	
Visibility	Try to ensure that things are visible so that people can see what functions are available and what the system is currently doing.
Consistency	Be consistent in the use of design features and be consistent with similar systems and standard ways of working.
Familiarity	Use language and symbols that the intended audience will be familiar with.
Affordance	Design things so it is clear what they are for; for example, make buttons look like push buttons so people will press them.
Effectiveness	
Navigation	Provide support to enable people to move around the parts of the system: maps, directional signs and information signs.
Control	Make it clear who or what is in control and allow people to take control.
Feedback	Rapidly provide feedback information from the system to people so that they know what effect their actions have had.

Safely and securely	
Recovery	Enable recovery from actions, particularly mistakes and errors, quickly and effectively.
Constraints	People should be prevented from making serious errors through properly constraining allowable actions and seeking confirmation of dangerous operations.
Accommodation	
Flexibility	Allow multiple ways of doing things so as to accommodate people with different levels of experience and interest in the system.
Style	Designs should be stylish and attractive.
Conviviality	Interactive systems should be polite, friendly and generally pleasant.

The guideline that emerged from this section of design principles is presented in Table 5.17.

Table 5.17: Emerging guideline from design principles – HCI_PRIN5

HCI_PRIN4: HCI design principles	Apply a set of guidelines for designing effective user interfaces.

The next section presents the principles for user interface design.

5.7.5 Principles for user interface design

Traditional heuristics do not consider the specific features of applications, therefore, numerous sets of usability heuristics have been developed for specific domains (Quiñones & Rusu, 2017). Nielsen (2005) developed ten general principles for designing user interfaces. These principles provide designers with a set of guidelines to help them create user-friendly and intuitive interfaces (Nielsen, 2005). The usability heuristics are presented in Table 5.18 to provide a simple framework for designers to follow when creating a user interface.

Table 5.18: Usability Heuristics (Nielsen, 2005:1)

Principle	Description
Visibility of system status	The system should always keep users informed about what is going on, through appropriate feedback within a reasonable time.
Match between the system and the real world	The system should speak the users' language, with words, phrases, and concepts familiar to the user, rather than system-oriented terms.
User control and freedom	Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue.
Consistency and standards	Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.
Error prevention	Even better than good error messages is a careful design which prevents a problem from occurring in the first place.
Recognition rather than recall	Minimize the user's memory load by making objects, actions, and options visible.
Flexibility and efficiency of use	Accelerators -- unseen by the novice user - may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users.
Aesthetic and minimalist design	Dialogues should not contain information which is irrelevant or rarely needed.
Help users recognize, diagnose, and recover from errors	Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.
Help and documentation	Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation.

The guideline that emerged from the section on principles for user interface design is presented in Table 5.19.

Table 5.19: Emerging guideline from the section on principles for user interface design – HCI_PRIN4

HCI_PRIN5: HCI user interface design principles	Employ a set of guidelines to create user-friendly and intuitive interfaces.

Shneiderman *et al.* (2016) introduced user interface design principles. The authors stated that a designer must address various individual differences in order to create a universally usable product. The design principles are presented in Table 5.20.

Table 5.20: User interface design principles

Principle	Description
Determine users' skill level	• <i>Novice or first-time users</i> • <i>Knowledgeable intermittent users</i> • <i>Expert frequent users</i>
Identify the tasks	This will include tasks that are done frequently, less frequently, or infrequently.
Choose an interaction style	• <i>Direct manipulation</i> • <i>Menu selection</i> • <i>Form fill-in</i> • <i>Command language</i> • <i>Natural language</i>
The eight golden rules of interface design	• <i>Strive for consistency.</i> • <i>Cater to universal usability.</i> • <i>Offer information feedback.</i> • <i>Design dialogues to yield closure.</i> • <i>Prevent errors.</i> • <i>Permit easy reversal of actions.</i> • <i>Support internal locus of control.</i> • <i>Reduce short-term memory loads.</i>
Prevent errors	Errors need to be prevented from occurring in the first place. When errors occur, users should be able to recover from them.

Principle	Description
Ensuring human control while increasing automation	Users are currently given more control by being shown potential traversals, being reminded, being alerted, and being provided with suggestions that guide their goals and methods (Shneiderman, 2022).

The guideline that emerged from the section on user interface design principles is presented in Table 5.21.

Table 5.21: Emerging guideline – HCI_PRIN6

HCI_PRIN6: User interface design principles	Address various individual differences in order to create a universally usable product.

A summary of the guidelines that emerged from the principles of HCI is presented in Table 5.22

Table 5.22: Summary of the emerging guidelines from HCI principles

HCI_PRIN1: Usability design principles	Take advantage of usability design principles to create a computer system that is both useful and easy to use.
HCI_PRIN2: Universal design principles	Make use of a set of guidelines for designing user interfaces and products that are accessible to all users, regardless of their abilities or disabilities.
HCI_PRIN3: HCI usability support principles	Use applicable principles that support and promote usability for an interactive system design.
HCI_PRIN4: HCI design principles	Apply a set of guidelines for designing effective user interfaces.
HCI_PRIN5: User interface design principles	Employ a set of guidelines to create user-friendly and intuitive interfaces.
HCI_PRIN6: User interface design principles	Address various individual differences in order to create a universally usable product.

The next section presents HCI practice experiences globally and in Africa.

5.8 HCI Practice

HCI is an interdisciplinary field involving technology and people (Kovalchick & Dawson, 2004). A wide range of skills and knowledge from engineering, computer science, and design are required to develop valuable and suitable HCI systems (Kuo *et al.*, 2019). In addition, (Ogunyemi *et al.*, 2019) stated that HCI practice involves the analysis, design, evaluation, and implementation of interactive systems by applying HCI concepts and techniques. The guideline that emerged from HCI practice segment is presented in Table 5.23. The code HCI_PRAC is used to represent emerging guidelines from HCI practice.

Table 5.23: Emerging guideline from HCI practice- HCI_PRAC1

HCI_PRAC1: HCI concepts and techniques	Ensure that the students are using HCI concepts and techniques to analyse, design, evaluate, and implement interactive systems.

This section presents the practice of HCI, starting with global perspectives, followed by experiences on the African continent.

5.8.1 Global perspectives

The research conducted by Rotard *et al.* (2005) was based on five years of experience in teaching the Graphical-Interactive Systems module. The main contribution of that research was to detail the curriculum for a one-semester module at the University of Stuttgart in Germany. The students in the module were studying computer science, software engineering, or information technology. In order to create a curriculum for the course, the lecturer adapted one from multiple textbooks. The lecturer used presentation slides to conduct classes. The copies of the slides served as the primary source of information for students. Afterwards, students were given exercises such as writing down human-machine interface designs. Students were able to improve their coding skills during their final assignment that involved programming. In terms of both content and method of teaching, the students rated

them as satisfying. The guideline that emerged from this segment is presented in Table 5.24. The code HCI_GP is used to represent emerging HCI guidelines from global perspectives.

Table 5.24: Emerging guideline from global perspectives - HCI_GP1

HCI_GP1: Conduct classes	Use presentation slides to conduct classes and give students an exercise to complete.

Oberdörfer *et al.* (2021) conducted a study at the same university, using pre-service teachers and HCI students as participants. From their research, the students acquired practical experience in incorporating cross-disciplinary Virtual and Augmented Reality learning environments into classroom teaching and learning. They also developed competencies by creating these applications. The guideline that emerged from this segment is presented in Table 5.25.

Table 5.25: Emerging guideline from global perspectives - HCI_GP2

HCI_GP2: Pedagogical concept	Incorporate cross-disciplinary learning environments into classroom teaching and learning.

Collazos and Merchan (2015) conducted a study in Columbia. In their research, the participants were software developers representing the industry, and professors representing academia. In their study, they identified a gap between what is taught in academia and what is done in industry. This research revealed that in industry, user testing was being performed on products by consulting companies. The authors also mentioned that the software industry population was not familiar with HCI education. Collazos and Merchan (2015) believed that HCI techniques and activities would enhance the products and offerings of Colombian software companies, because HCI is implemented in mainstream software engineering practices. The guideline that emerged from this section is presented in Table 5.26.

Table 5.26: Emerging guideline from global perspectives - HCI_GP3

HCI_GP3: User testing	Ask students to integrate activities such as user testing and those that involve what is done in the industry to enhance designs.

Figure 5.3 presents the courses offered at different universities in Columbia.

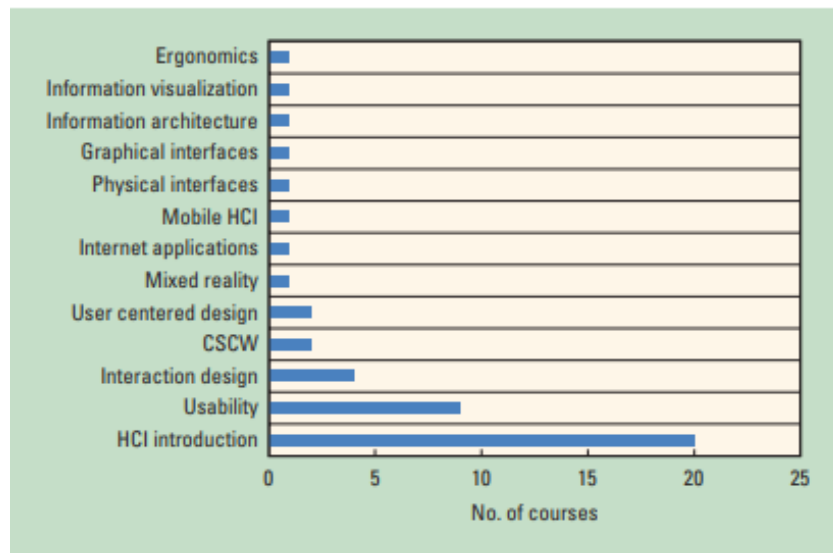


Figure 5.3: HCI courses offered at Columbia universities (Collazos & Merchan, 2015)

Wilcox *et al.* (2019) conducted an online survey to determine the topics that are lectured in HCI classes by the HCI instructors and by using HCI course syllabuses that are available publicly. The respondents were from the United States, Latin America, Europe and South Asia. Figure 5.4 presents the data collected from participants regarding HCI topics taught at their respective academic institutions. The results included several topics.

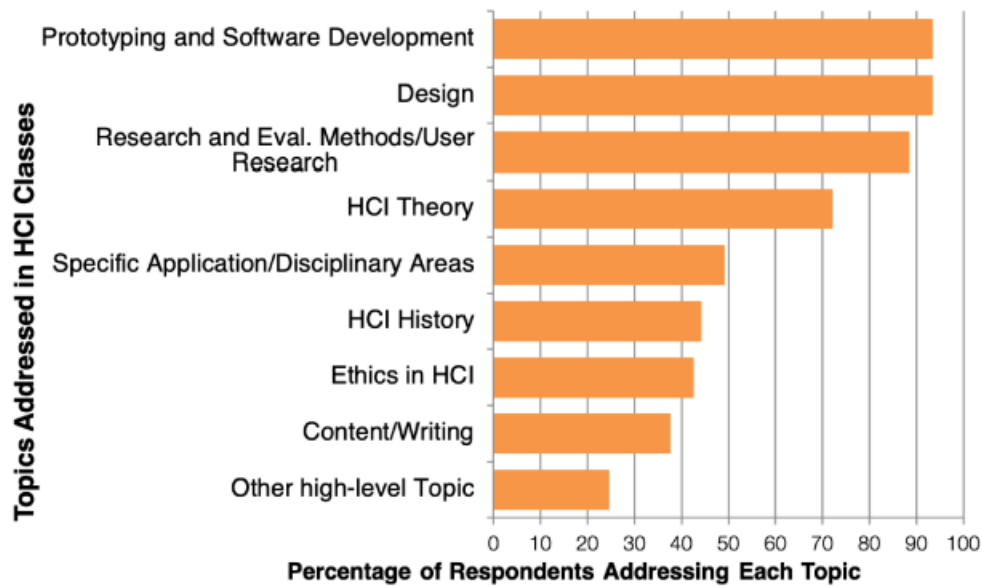


Figure 5.4: Topics addressed in HCI classes (Wilcox *et al.*, 2019)

A summary of the guidelines that emerged from this section on global perspectives is presented in Table 5.27.

Table 5.27: Summary of emerging guidelines from global perspectives – HCI_GP

HCI_GP1: Conduct classes	Use presentation slides to conduct classes and give students an exercise to complete.
HCI_GP2: Pedagogical concept	Incorporate cross-disciplinary learning environments into classroom teaching and learning.
HCI_GP3: User testing	Ask students to integrate activities such as user testing and those that involve what is done in the industry to enhance products.

This section presented the different countries that practice HCI, and the topics addressed. The next section focuses on the HCI practices in Africa.

5.8.2 African experience

HCI is still in its early stages in Africa according to Lazem *et al.* (2018). The authors note that the first conference was held in 2016 in Nairobi, Kenya, where presenters were allowed to share their work on teaching HCI in their native language. The conference was also named in Swahili. It was given the name BAZARA, which means "meeting." The presenters discussed their curricular experiences and the

institutional challenges they face. According to the findings, Namibia and South Africa were the only countries with established HCI groups. The other countries had one or two faculty members with HCI degrees acquired outside their home countries. It was suggested that modern African HCI should address sociological and anthropological issues in order to reflect the African social context and ensure that the majority of people are involved. The findings also revealed the importance of reflecting on an up-to-date understanding of African community concepts. The issues raised at the conference remain relevant to this day. Large classes, focusing on theoretical concepts of interface design and evaluation rather than practising them, a lack of computers, and a lack of current textbooks are some of the challenges mentioned. Students are left with no work experience to draw on when they enter the workforce. Because HCI is a practical subject, the authors also mentioned the gap between what is studied, which is the theory, and its practice. (Ogunyemi *et al.*, 2016) conducted a literature review and realized that software organizations lack theoretical guidance when adopting HCI practices. The guidelines that have emerged from this segment are presented in Table 5.28. The code HCI_EA is used to represent emerging HCI guidelines from the African experience.

Table 5.28: Emerging guideline from the African experience - HCI_AE

HCI_AE1: User's social context	Understand the social context to ensure that the majority of people are catered for in the design.
HCI_AE2: Work experience	Ensure that students gain adequate practical experience to use as part of their work experience.

Lazem *et al.* (2022) wrote an article on how Egyptian engineering schools could benefit from offering HCI training to their students. The authors noted that, in Arab and African countries, there is a lack of rich training for students, which is more visible in HCI education. The students were assisted in developing a better understanding of the users' role in design through action research. Three action research cycles were conducted. The emphasis was on creating “a student-centred, open, reflective, and active learning environment” (Lazem *et al.*, 2022:12). The results of the third cycle revealed that there were other reasons that attracted students to HCI courses, such as the opportunity to work in teams, the innovation of

hands-on experience, developing prototypes, and the social challenges addressed in the projects. The authors recommended that instructors could make this type of activity more engaging and fun by exploring different ideas. The guidelines that have emerged from this segment on from the African experience are presented in Table 5.29.

Table 5.29: Emerging guidelines from the African experience - HCI_AE

HCI_AE3: Users' role	Assist the students to develop a better understanding of the users' role in design.
HCI_AE4: Social challenges	Ensure that social challenges are addressed in the projects.
HCI_AE5: Different ideas	Explore different ideas to make activities fun and engaging.

Terblanche and Goede (2014) conducted a study in South Africa, where the requirement of the course was for students to use HCI principles and design research methodologies to create interactive glossaries for an interactive study guide. Their results indicated that students were satisfied with their work, but had difficulty managing their time. The research did not reveal the reasons why students did not manage their time. Lund and Wiese (2021) noted that the time management field examines how abstract tasks can be broken down to ensure their completion. The guideline that emerged from this section on the African experience is presented in Table 5.30.

Table 5.30: Emerging guideline from the section on the African experience - HCI_AE6

HCI_AE6: Time management	Guide students on how to break down abstract tasks to manage their time.

According to Katona (2021), higher education has witnessed the emergence of eLearning over the past decade, which has made static content available online. The author also indicated that labs that operate remotely and virtually are currently on the rise. Czerniewicz *et al.* (2019) assert that full-time online distance education was authorized in 2014 by the national regulatory frameworks for traditional universities. Between 2015 and 2017, the South African higher education sector saw protests and

university closures; however, some universities used blended and online delivery to complete the academic year and curriculum (Czerniewicz *et al.*, 2019; Swartz *et al.*, 2018; Tekane *et al.*, 2018). In 2020, with the outbreak of the COVID-19 pandemic, there was a rapid transition of teaching and learning from a traditional classroom setting to a hybrid model of online and traditional learning around the world (Pal & Vanijja, 2020). At one of the South African universities, the HCI lecturer documented her teaching experiences during the COVID-19 pandemic (De Wet, 2021). Regardless of whether students worked individually or in groups, the author noted that explaining the related theory and involving them practically was always beneficial. Class attendance was compulsory; however, during the lockdown, it was poor when classes were conducted online due to COVID-19. The guidelines that emerged from the African experience segment are presented in Table 5.31.

Table 5.31: Emerging guideline - HCI_AE4

HCI_AE7: Theory-practice gap	Provide students with more opportunities to do practical work based on theory.
HCI_AE8: Interactive lecture	Explore different methods to involve the students in the learning process.
HCI_AE9: Hybrid classes	Allow students to attend theory classes online or face-to-face.

A summary of the guidelines that emerged from this section on the African experience is presented in Table 5.32.

Table 5.32: Summary of emerging guidelines from the African experience – AE

HCI_AE1: User's social context	Understand the social context to ensure that the majority of people are addressed in the design.
HCI_AE2: Work experience	Ensure that students gain adequate practical experience to use as part of their work experience.
HCI_AE3: Users' role	Assist the students in developing a better understanding of the users' role in design.
HCI_AE4: Social challenges	Ensure that social challenges are addressed in the projects.
HCI_AE5: Different ideas	Explore different ideas to make activities fun and engaging.

HCI_AE6: Time management	Guide students on how to break down abstract tasks to manage their time.
HCI_AE7: Theory-practice gap	Provide students with more opportunities to do practical work based on theory.
HCI_AE8: Interactive lectures	Explore different methods to involve the students in the learning process.
HCI_AE9: Hybrid classes	Allow students to attend theory classes online or face-to-face.

The next section discusses the challenges associated with teaching and learning HCI content.

5.9 Challenges experienced in HCI classes

Several researchers have identified the difficulties encountered in HCI classes. Large class sizes have proven to be a problem when it comes to classes that require the use of computers during class (Lazem *et al.*, 2018). According to Jeon *et al.* (2019), a challenging aspect of teaching HCI is its multidisciplinary nature.

Wilcox *et al.* (2019) conducted a study that addressed design education in the HCI classroom. The results of their study showed that teaching a class of 40 students without co-teaching was impossible, whereas teaching a class of 25 students was challenging. Additionally, the authors mentioned that the size of the class affects the amount of hands-on support that can be offered to students for their designs.

The guideline that emerged from this segment is presented in Table 5.33. The code HCI_CE is used to represent emerging HCI guidelines from challenges experienced in HCI classes.

Table 5.33: Emerging guideline from challenges in HCI classes - HCI_CE1

HCI_CE1: Co-teaching.	Allow co-teaching to provide more hands-on support to students for their practical work.

Roldan *et al.* (2020) identified the difficulty in introducing the concept of engaging with real users to students due to a lack of knowledge in that area. The authors recommended that students and educators use reflective practices when designing for users. The idea of using reflection arose after the students observed how they interacted with the users in the project they were involved in. This provided them with the opportunity to reflect on their actions. In 2021, they continued with the implementation of reflective practice in another research study (Roldan *et al.*, 2021). This study incorporated the implementation of the best methods by a multidisciplinary group of researchers, professional development facilitators, and educators in an HCI class. Students used reflective strategies to include end users in their investigational design, allowing them to broaden their investigation when studying users. The whole process was recorded on videos and later on, the students were able to watch themselves in the videos and reflect on their actions. They concluded that because there are limited time and resources in the HCI class context, tools that aid in quick guidance and video distribution among students can be used (Roldan *et al.*, 2021). The guideline that emerged from this segment on challenges in HCI classes is presented in Table 5.34.

Table 5.34: Emerging guideline from challenges in HCI classes - HCI_CE2

HCI_CE2: Reflective strategies	Encourage students to use reflective strategies to incorporate end users into their investigational design in order to broaden the scope of their studies.

The problem of incorporating personas into practice was illustrated in a research study conducted by Warin *et al.* (2018). An overview of the personas was provided to the students. The description provided reflected the characteristics of the person using the system. To demonstrate their understanding of the persona, students had to come up with an interactive system. The authors noted that it was difficult to identify relevant features for a design using personas because they lacked specifics and critical details. It was proposed that instructors could play the role of the personas to give the personas life. Using this method, students would gain a better sense of their personas' characteristics. The guideline that emerged from the segment on challenges in HCI classes is presented in Table 5.35.

Table 5.35: Emerging guideline from challenges in HCI classes - HCI_CE3

HCI_CE3: Personas	Play the role of the persona for the students to understand.

Roudaut *et al.* (2018) noted that HCI is a multidisciplinary field. Being multidisciplinary is a challenge, because it is difficult to identify the relevant topics to teach. Designers of HCI content tend to emphasise aspects related to the unit they are teaching or based on their interests or capabilities.

Another challenge identified is that HCI is an applied field (Roudaut *et al.*, 2018). HCI is a highly theoretical field that can be used as the basis for design processes; however, it is predominantly a practical and applied discipline aimed at addressing the needs of users in creating interfaces and products. Some HCI skills should be performed manually under certain circumstances, whereas others should be practised on a regular basis. The skills required to develop physical prototyping require practice. They further stated that knowing the principles and applying them to practice requires a specific set of skills. Table 5.36 presents the guideline that emerged from the segment on challenges in HCI classes.

Table 5.36: Emerging guideline from challenges in HCI classes - HCI_CE4

HCI_CE4: Prototyping	Promote the practice of developing physical prototyping among students to gain a specific set of skills.

The field of HCI is primarily applied and practical, with the objective of developing tools and interfaces that are convenient and satisfying for the user, although it has many theoretical components that serve as pillars for its design process (Roudaut *et al.*, 2018). Kovalchick and Dawson (2004) also indicated that a central element of HCI includes its scientific aspect, which includes an application of theory for how individuals interact with tools like computers to accomplish tasks and a practical component in which useable interfaces are designed.

Another challenge is that HCI is a new field. Compared to other common fields such as Biology, HCI is relatively new. Roudaut *et al.* (2018) asserted that it is common for colleagues from other fields to ask what HCI is. The authors further stated that it was

often necessary to explain the various skills of HCI researchers. Despite these explanations, their results indicate that it is still unclear whether HCI is a science or an engineering field. The other thing is that theory and application of HCI are equally difficult to explain to other researchers.

Pittarello and Pellegrini (2017) observed from the ACM CHIItaly conference workshop that undergraduate Computer Science students received unsuitable training even though there were HCI introductory courses. The gap between theory and practice was obvious, and there was consensus among most participants who attended the workshop that it needed to be bridged. The proposal was to offer students technical skills that they could advance in the industry. The participants also realised that most classes were based on theoretical work, which made the students passive. The guideline that emerged from the segment on challenges in HCI classes is presented in Table 5.37.

Table 5.37: Emerging guideline from challenges in HCI classes - HCI_CE5

HCI_CE5: Theory-practice gap	Offer students technical skills that they could put forward in the industry.

A summary of the guidelines that emerged from this section on challenges in HCI classes is presented in Table 5.38.

Table 5.38: Summary of emerging guidelines from challenges in HCI classes – CE

HCI_CE1: Co-teaching	Allow co-teaching to provide more hands-on support to students for their practical work.
HCI_CE2: Reflective strategies	Encourage students to use reflective strategies to incorporate end users into their investigational design in order to broaden the scope of their studies.
HCI_CE3: Personas	Play the role of the persona for the students to understand.
HCI_CE4: Prototyping	Promote the practice of developing physical prototyping among students to gain a specific set of skills.
HCI_CE5: Theory-practice gap	Offer students technical skills that they could put forward in the industry.

The next section focuses on conducting HCI classes.

5.10 Conducting HCI classes

A common practice is that HCI theoretical classes are conducted first, followed by practical work. According to research conducted by Pérez-Marín *et al.* (2022), in traditional classes before COVID-19, students were given an exercise to complete in class, and practical sessions were held in the lab. They also showed that this was common practice in universities with face-to-face classes. Participants at the Association for Computing Machinery Biannual Conference of the Italian Chapter of the SIGCHI (ACM CHIItaly) conference workshop proposed that more time should be allocated to teaching design projects (Pittarello & Pellegrini, 2017). This was suggested after realising that there was more emphasis on theory during the classes. The participants also suggested a bottom-up approach in which the application would be developed first by the students, before they learnt about the relevant theories and principles.

Table 5.39 presents the guidelines that emerged from this segment. Code HCI_CL is used to represent emerging HCI guidelines from conducting HCI classes.

Table 5.39: Emerging guidelines from conducting HCI classes- HCI_CL

HCI_CL1: Conducting HCI classes	Conduct theoretical classes first followed by practical classes in a lab.
HCI_CL2: Time for practical work	Allocate more time for practical classes.

Guimarães and Prates (2018), in their research conducted in Brazil, found that HCI was typically taught through course projects that incorporate evaluation and design, allowing students to experiment with a variety of methods. The students were exposed to both theoretical and practical knowledge of HCI through project-based courses. Terblanche and Goede (2014) conducted a project-based learning study to teach HCI at a South African university. The students were tasked with developing interactive glossaries for various chapters of the Mathematics electronic study guide.

The HCI principles were used in the evaluation along with the design science research methodology. According to their findings, students were able to comprehend HCI concepts and understand the importance of applying HCI principles.

Table 5.40 presents the guideline that emerged from the segment on conducting HCI classes.

Table 5.40: Emerging guideline from conducting HCI classes - HCI_CL3

HCI_ CL3: Project-based work	Expose students to both theoretical and practical knowledge of HCI through project-based work.

Globally, COVID-19 has influenced how teaching and learning are conducted (Johnson *et al.*, 2020). Nonetheless, it was necessary to continue learning during the pandemic. Classes had to be moved online to contain the virus (Ali, 2020; Christian *et al.*, 2021; Oraif & Elyas, 2021; Ramlo, 2021). Adeyeye *et al.* (2022), examined 21 universities in South Africa, and noted that only 17 shifted to online learning during the lockdown period. However, online learning was not a new approach adopted in South Africa.

Universities used a variety of platforms and information technology tools to deliver classes online (Kulikowski *et al.*, 2022). Among those tools, Microsoft Teams (Adeyeye *et al.*, 2022; Christian *et al.*, 2021) and Collaboration in Blackboard were the most common tools for conducting online classes (Pérez-Marín *et al.*, 2022). Another online platform used for online classes was Zoom (Alchamdani *et al.*, 2020; Fitria, 2020; Mpungose, 2021; Serhan, 2020). As a result of these online learning environments, students were able to learn more effectively by interacting, collaborating, and taking responsibility for their learning (Ali, 2020). The guideline that emerged from this section on online learning is presented in Table 5.41.

Table 5.41: Emerging guideline - HCI_CL3

HCI_ CL4: Online learning environments	Allow students to learn more effectively by interacting, collaborating, and taking responsibility for their learning through online learning environments.

Although online teaching and learning have many benefits and have been widely adopted, the results of the research conducted by Pittarello and Pellegrini (2017) revealed significant difficulties during HCI classes when communicating, being unable to sketch, and experiencing a lack of interpersonal relationships. Another challenge with online learning is that universities are the only ones that have the required equipment for practical classes (Christian *et al.*, 2021).

A summary of the guidelines that emerged from this section on conducting HCI classes is presented in Table 5.42.

Table 5.42: Summary of emerging guidelines – CL

HCI_CL1: Conducting HCI classes	Conduct theoretical classes first followed by practical classes in a lab.
HCI_CL2: Time for practical work	Allocate more time for practical classes.
HCI_CL3: Project-based work	Expose students to both theoretical and practical knowledge of HCI through project-based work.
HCI_CL4: Online learning environments	Allow students to learn more effectively by interacting, collaborating, and taking responsibility for their learning through online learning environments.

5.11 HCI guidelines from literature

Table 5.43 shows the identified guidelines from the literature review as well as a summary. The code HCI_G is used to represent enriched HCI guidelines.

Table 5.43: HCI guidelines from literature

Revised guideline code	Related topic	Guideline	Reference
HCI_G1	Theory-practice gap	Incorporate practical experience based on theoretical knowledge to develop valuable industry-ready skills.	HCI_ACA1; HCI_AE2; HCI_AE7; HCI_CE5
HCI_G2	User testing	Ask students to integrate activities such as user testing and those that involve what is done in the industry to enhance designs.	HCI_GP3
HCI_G3	Conducting HCI classes	Conduct theoretical classes first followed by practical classes in a lab.	HCI_CL1
HCI_G4	User's social context	Encourage students to incorporate reflective practices and consider the perspectives of users and their social context while creating designs and engaging with end users to broaden the scope of their research.	HCI_GL1; CI_GL2; HCI_AE1; HCI_AE4; HCI_CE2
HCI_G5	User's role	Assist the students in developing a better understanding of the users' role in design.	HCI_AE3
HCI_G6	User experience	Emphasise the importance of usability and user experience to students.	HCI_ACA2
HCI_G7	HCI principles and goals	Assist students in using appropriate HCI principles and goals for the current context in their work to analyse, design, evaluate, and implement interactive systems for universal use.	HCI_GL3; HCI_PR1; HCI_PRAC1; HCI_PRIN1; HCI_PRIN2; HCI_PRIN3; HCI_PRIN4; HCI_PRIN5; HCI_PRIN6

Revised guideline code	Related topic	Guideline	Reference
HCI_G8	Interactive lecture	Explore different ideas to make activities fun and involve the students in the learning process by assigning a case study based on theory work.	HCI_AE5; HCI_AE8; HCI_ACA3; HCI_CL3
HCI_G9	Presentation slides	Use presentation slides to conduct classes and give students an exercise to complete.	HCI_GP1
HCI_G10	Pedagogical concept	Incorporate cross-disciplinary learning environments into classroom teaching and learning.	HCI_GP2
HCI_G11	Hybrid classes	Allow students to attend theory classes online or face-to-face.	HCI_AE9
HCI_G12	Online learning environments	Allow students to learn more effectively by interacting, collaborating, and taking responsibility for their learning through online learning environments.	HCI_CL4
HCI_G13	Time management	Guide students on how to break down abstract tasks to manage their time.	HCI_AE6
HCI_G14	Co-teaching	Allow co-teaching to provide more hands-on support to students for their practical work.	HCI_CE1
HCI_G15	Personas	Play the role of the persona for the students to understand.	HCI_CE3
HCI_G16	Prototyping	Promote the practice of developing physical prototyping among students to gain a specific set of skills.	HCI_CE4

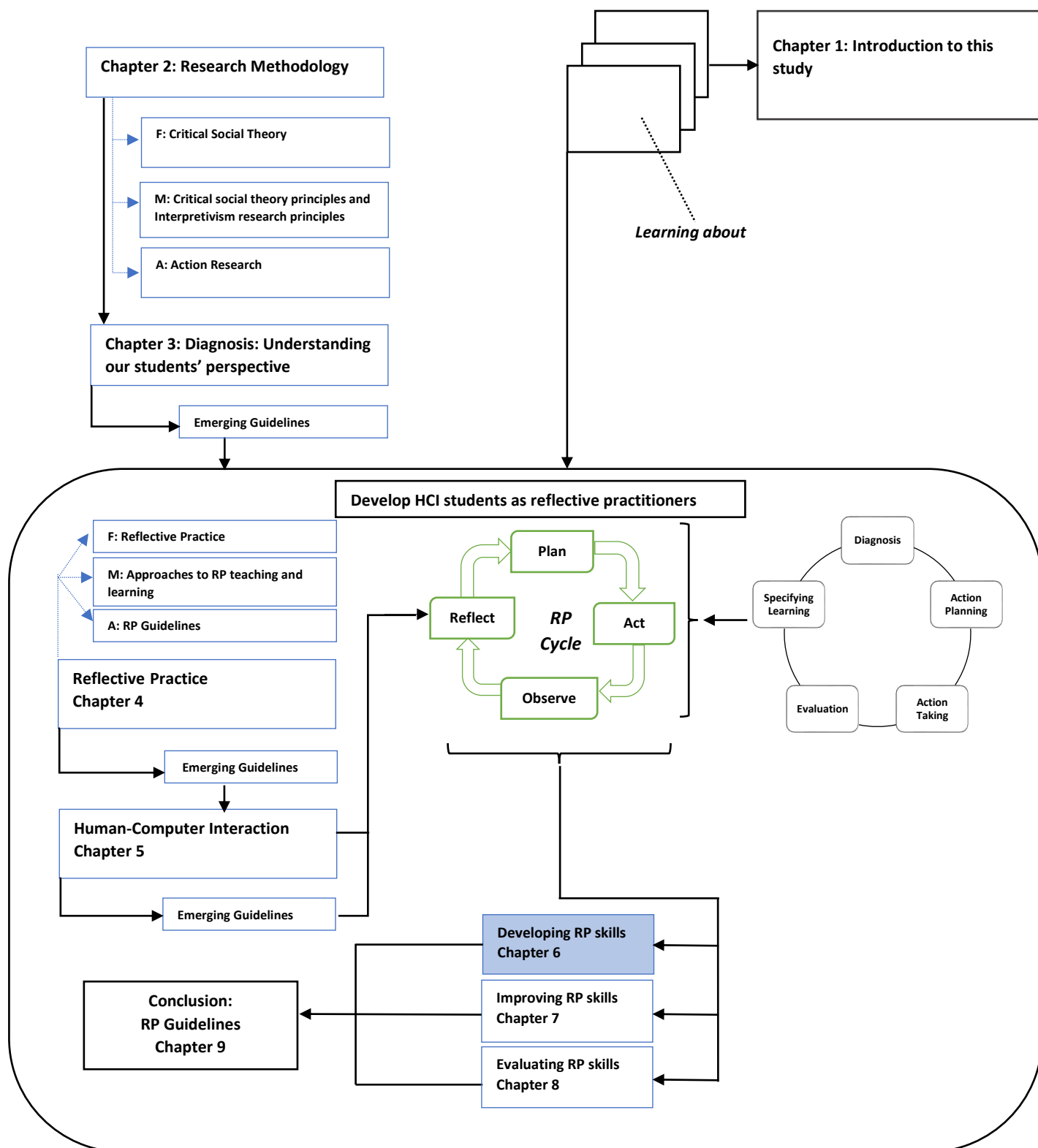
5.12 Chapter summary

This chapter gave an overview of current research and discussions on HCI as a framework of ideas towards developing HCI students as reflective practitioners. The chapter started with an overview of the definitions of HCI presented in Section 5.2.

The findings from the literature revealed that there is a gap between the theory and practice of HCI. In Section 5.3, the historical background of HCI was provided. Section 5.4 presented the role of HCI in academia and the importance of incorporating HCI. The differences between national and international guidelines were presented; national guidelines were more topic-specific, whereas international guidelines provided learning outcomes. The need to develop guidelines was also highlighted.

The fields that contribute to the HCI discipline were described in Section 5.5. The section revealed the multidisciplinary nature of the HCI field. Section 5.6 discussed the goals of HCI: safety, utility, effectiveness, efficiency, and usability. The section also highlighted that the goal of HCI is to provide users with the best possible experience. Section 5.7 presented the principles of HCI. The importance of incorporating these principles when designing an interface was highlighted. In section 5.8, global perspectives and African experiences on the practice of HCI and the topics addressed were presented. The challenges experienced in HCI classes in terms of teaching and learning were presented in Section 5.9.

Section 5.10 presented how HCI classes are conducted from different perspectives. The chapter ended with the enriched HCI guidelines presented in Section 5.11. The guidelines will assist with developing the HCI students as reflective practitioners.



CHAPTER 6: DEVELOPING REFLECTIVE PRACTICE SKILLS

6.1 Introduction

The primary objective of this study is to formulate guidelines for developing human-computer interaction (HCI) students as reflective practitioners.

In this chapter, the first action research cycle is presented, with the aim of developing reflection skills among students. The cycle begins with the diagnosis phase (Section 6.2), in which the guidelines from the diagnosis phase presented in Chapter 3 and the guidelines from the literature review presented in Chapters 4 and 5 are examined to develop a plan of action.

In Section 6.3, a possible intervention strategy is provided for each guideline during the action-planning phase. The intervention consisted of a plan of action to verify the suitability of the guidelines, with the aim of extending them to incorporate into the learning context of HCI students. The intervention was performed during the action-taking phase as presented in Section 6.4.

During the evaluation phase described in Section 6.5, data from the participants were evaluated to determine the suitability of the guidelines. This was done to obtain a contextual perspective on what needs to be changed or to formulate guidelines for developing HCI students as reflective practitioners. Reflections from each category were presented during the “specify learning” phase to formulate recommendations that was used in the next cycle for students to gain reflective skills and to inform the guidelines to be developed, as presented in Section 6.5.4. Section 6.6 presents the reflections from each category in the “specify learning” phase. The verification of the guidelines is presented in Section 6.7. Section 6.8 provides the limitations of the first AR cycle. Finally, the conclusions are presented in Section 6.9.

6.2 Diagnosis phase

The students’ problems were diagnosed, as reported in Chapter 3. From the diagnosis, an applicable framework of understanding was selected, namely reflective practice (RP), as presented in Chapter 4. Guidelines for interventions were further

identified based on RP in Chapters 4 and 5 in the context of the HCI module content. The guidelines in Chapter 3 were formulated based on data collected from students who had taken the HCI module in the preceding year. The guidelines formulated from diagnosis and literature chapters are presented.

This section provides the guidelines formulated from the diagnosis chapter (Chapter 3) and the RP and HCI literature chapters (Chapters 4 and 5, respectively). The guidelines from the students' data in Chapter 3 from Table 3.13 are listed in Table 6.1.

Table 6.1: Guidelines from students' data

Guideline code	Guideline	Reference
GDP1: Question-answer session.	Establish a platform that encourages students to ask questions about the parts of the work they find challenging.	GSD1
GDP2: Understand the question	Request students to make sure they understand the question first before attempting to answer it.	GSD2
GDP3: Research	Ask students to seek more information about the topic to gain more knowledge.	GSD3
GDP4: Theory-practice gap.	Teach theoretical content first for students to understand the practical component of the module.	GSD4
GDP5: Students bridging the theory-practice gap.	Request students to learn theory first to understand the practical component of the module.	GSD5
GDP6: Time management	Assist students with strategies on how to manage time effectively.	GSD5
GDP7: Prior knowledge	Incorporate work that will give students a chance to use prior knowledge.	GSD6
GDP8: Attending classes	Recommend to students to attend all scheduled theory and practical classes.	GLO1
GDP9: Preparing for lecture	Ask students to prepare thoroughly for the lecture by reading the relevant section before attending.	GLO2

Guideline code	Guideline	Reference
GDP10: Studying after lecture	Request students to review the section after the lecture before the next one.	GLO3
GDP11: Completing assigned work.	Advise students to complete all the assigned work.	GLO4
GDP12: Acquiring correct answers	Ask students to get accurate answers afterward and have a thorough understanding of them.	GLO5

The guidelines that emerged from the RP literature in Chapter 4 are listed in Table 6.2. The Table is a copy of Table 4.67 with a guideline code, related topic, guideline, and the final column referencing the development of these guidelines from RP literature.

Table 6.2: Guidelines from the RP literature

Guideline code	Related topic	Guideline	Reference
RP_G1	Experiential learning	Promote the completion of a new task that will allow the students to construct their knowledge when they apply theoretical content to a specific situation.	Dewey1; Kolb2; Kolb5; RP_Lit9; Zwodiak1
RP_G2	Reflective practice strategy	Integrate reflective practice as a strategy into students' learning to assist them in completing the work and how to improve their learning.	RP_Def1; RP_Def3; Zwodiak9
RP_G3	Critical skills	Encourage students to critically examine their own assumptions and those of the methods they chose.	Lawrence1; RP_Lit11
RP_G4	Description of the event	Ask students to reflect on one event by describing their perceptions and not to make any judgments at this stage.	Gibbs1; Rolfe1
RP_G5	Decision making	Promote effective decision-making and	Dewey2; Schön;

Guideline code	Related topic	Guideline	Reference
		justification for a specific process.	Schön5; Gibbs4; Gibbs5; Gibbs6; RP_Def2; RP_Lit7; RP_Lit14; Zwodiak5; Zwodiak6
RP_G6	Reflecting on the process	Document what went well, and the challenges experienced that will need to be addressed in decision-making processes.	Schön4; Gibbs2; Gibbs3; Kolb3; Rolf2; Rolf3; RP_Lit1; RP_Lit3; RP_Lit5; Zwodiak4; McCoach1
RP_G7	Monitoring reflection	Integrate reflection into students' work in a way that makes it possible to monitor that they engage in reflection.	RP_Lit13
RP_G8	Detailed feedback	Provide students with detailed feedback quickly to enable them to reflect on their assessed work and to make changes for further action.	RP_Lit10; RP_Lit15
RP_G9	Reflective guidelines	Provide students with guidance on how to reflect on their studies.	RP_Lit16
RP_G10	Linking theory with practice	Ask students to evaluate what they have learned through practice.	Kolb1; Zwodiak3; RP_Lit2
RP_G11	Prior knowledge	Assist students in reflecting on their experiences in terms of their prior knowledge and knowledge gaps by adding reflection as a key process in their learning cycle.	Dewey5; Schön1; Lawrence2; Schön2; ERTL_Lit1; RP_Lit4; RP_Lit12; Kolb4
RP_G12	External factors	Consider factors that influence individuals and practices outside of the practice domain.	Dewey3; McCoach3
RP_G13	Evaluation standards	Develop a rubric to guide the students on how they will be assessed and to	RP_Lit6

Guideline code	Related topic	Guideline	Reference
		facilitate evaluation standards.	
RP_G14	Maximise students' potential learning	Customise learning by applying different strategies when teaching to accommodate individual needs.	Zwodiak7; RP_Lit7
RP_G15	Reflective Journal	Encourage students to maintain a reflective journal to become aware of their thoughts, feelings, and reactions to different situations.	RP_Lit8
RP_G16	Evaluate own teaching	Use feedback from formative evaluation in the classroom to make adjustments for further action.	Dewey4; Zwodiak2; McCoach2
RP_G17	Enhance teaching quality	Reflect on lesson outcomes and acquire a variety of knowledge bases and models for teaching.	Zwodiak8
RP_G18	Reflective skills	Develop specific skills to support various reflection strategies.	RP_Def2; RP_Lit7; Schön5; Gibbs6; RP_Lit14; Zwodiak6
RP_G19	Problem-solving skills	Develop a set of basic skills in order to suggest possible solutions from various perspectives.	Dewey2; Gibbs4; Zwodiak5; Schön3
RP_G20	Reflecting on learning	Inspire students to add reflection as a key process in their learning cycle.	Schön2; ERTL_Lit1; RP_Lit4; RP_Lit12; Kolb4

The guidelines that emerged from the HCI literature presented in Chapter 5 are listed in Table 6.3. This Table is a copy of Table 5.43 with a guideline code, related topic, guideline, and column referencing how these guidelines were developed based on the HCI literature.

Table 6.3: Guidelines from the HCI literature

Guideline code	Related topic	Guideline	Reference
HCI_G1	Theory-practice gap	Incorporate practical experience based on theoretical knowledge to develop valuable industry-ready skills.	HCI_ACA1; HCI_AE2; HCI_AE7; HCI_CE5
HCI_G2	User testing	Ask students to integrate activities such as user testing and those that involve what is done in the industry to enhance designs.	HCI_GP3
HCI_G3	Conducting HCI classes	Conduct theoretical classes first followed by practical classes in a lab.	HCI_CL1
HCI_G4	User's social context	Encourage students to incorporate reflective practices and consider the perspectives of users and their social context while creating designs and engaging with end users to broaden the scope of their research.	HCI_G1; HCI_G2; HCI_AE1; HCI_AE4; HCI_CE2
HCI_G5	User's role	Assist the students in developing a better understanding of the users' role in design.	HCI_AE3
HCI_G6	User experience	Emphasise the importance of usability and user experience to students.	HCI_ACA2
HCI_G7	HCI principles and goals	Assist students in using appropriate HCI principles and goals for the current context in their work to analyse, design, evaluate, and implement interactive systems for universal use.	HCI_G3; HCI_PR1; HCI_PRAC1; HCI_PRIN1; HCI_PRIN2; HCI_PRIN3; HCI_PRIN4; HCI_PRIN5; HCI_PRIN6
HCI_G8	Interactive lecture with a case study	Explore different ideas to make activities fun and involve the students in the learning process by assigning a case study based on theory work.	HCI_AE5; HCI_AE8; HCI_ACA3; HCI_CL2
HCI_G9	Presentation slides	Use presentation slides to conduct classes and provide students with an	HCI_GP1

Guideline code	Related topic	Guideline	Reference
		exercise to complete.	
HCI_G10	Pedagogical concept	Incorporate cross-disciplinary learning environments into classroom teaching and learning.	HCI_GP2
HCI_G11	Hybrid classes	Allow students to attend theory classes online or face-to-face.	HCI_AE9
HCI_G12	Online learning environments	Allow students to learn more effectively by interacting, collaborating, and taking responsibility for their learning through online learning environments.	HCI_CL3
HCI_G13	Time management	Guide students on how to break down abstract tasks to manage their time.	HCI_AE6
HCI_G14	Co-teaching	Allow co-teaching to provide more hands-on support to students for their practical work.	HCI_CE1
HCI_G15	Personas	Play the role of the persona for the students to understand.	HCI_CE3
HCI_G16	Prototyping	Promote the practice of developing physical prototyping among students to gain a specific set of skills.	HCI_CE4

6.2.1 Merged guidelines

In this section, guidelines that have the same meaning are merged. Two guidelines, each offering unique perspectives, were intentionally combined to provide a more thorough understanding. The guidelines presented in Table 6.4 have been consolidated because although they emerge from different sources, they overlap. The merged guidelines are extracted from Table 6.1, Table 6.2, and Table 6.3. The MG code was used to refer to the merged guidelines.

Table 6.4: Consolidated guidelines (Cycle 1)

Guideline code	Guideline	Reference from Table 6.1, Table 6.2, and Table 6.3
MG1: Research and understand the question	Request students to seek more information about the topic and understand the question before attempting to answer it.	GDP2 GDP3
MG2: Prior knowledge	Provide students with an opportunity to reflect on their experiences in terms of their prior knowledge and knowledge gaps by adding reflection as a key process in their learning cycle.	RP_G1; RP_G11; GDP7
MG3: Document experiences	Ask students to document successes and challenges that will need to be improved in decision-making and justification for a chosen process.	RP_G5, RP_G6
MG4: Lecture method	Teach theoretical content first for students to understand the practical component of the module followed by practical classes in a lab.	GDP4; HCI_G3
MG5: Time management	Guide students on how to break down abstract tasks to manage their time by providing them with a step-by-step process.	HCI_G13; GDP6

6.2.2 Categorised guidelines

The following guidelines serve as a reference for the purpose of developing HCI students as reflective practitioners. The guidelines were divided into five sections to achieve the objectives of this study. Codes are also presented to distinguish the guidelines based on their categories. The first section presents guidelines for setting a specific assignment to bridge the theory-practice gap, using the TPG code. The guidelines aim to address the theory-practice gap in HCI classes. Students are expected to be able to apply theoretical knowledge in practical settings.

The second section provides guidelines for guiding reflection by and among students, using the RSG code. The guidelines are designed to offer guidance to students on how to engage in self-reflection on their academic studies.

General advice to students to improve performance is presented in the third section, using the IPG code. The purpose of these guidelines is to provide advice on how students can improve their performance in their studies.

The fourth section provides guidelines related to the assessment strategy to promote reflection, using the ASG code. These guidelines are intended to encourage reflection among students during the assessment process.

The last section covers the guidelines for overall instructional design orientation, using the IDG code. The objective of these guidelines is to provide information for the development and presentation of teaching plans for HCI lecturers. The guidelines are presented in Table 6.5.

Table 6.5: Guidelines for developing HCI students as reflective practitioners

Guideline Code	Guideline	Reference from Tables 6.1, 6.2 6.3 and 6.4
Setting a specific assignment to bridge the theory-practice gap.		
TPG1: HCI principles and goals	Assist students in using appropriate HCI principles and goals for the current context in their work to analyse, design, evaluate, and implement interactive systems for universal use.	HCI_G7
TPG2: User's social context	Encourage students to incorporate reflective practices and consider the perspectives of users and their social context while creating designs and engaging with end users to broaden the scope of their research.	HCI_G4
TPG3: External factors	Ask students to evaluate external factors that may affect individuals and practices.	RP_G12
TPG4: Linking theory with practice	Ask students to evaluate what they have learned through practice.	RP_G10
TPG5: Interactive lecture	Explore different ideas to make activities fun	HCI_G8

Guideline Code	Guideline	Reference from Tables 6.1, 6.2 6.3 and 6.4
with a case study	and involve the students in the learning process by assigning a case study based on theory work.	
TPG6: User's role	Assist the students in developing a better understanding of the users' role in design.	HCI_G5
TPG7: Prototyping	Ask students to develop physical prototyping to gain specific skills.	HCI_G16
TPG8: User testing	Ask students to integrate activities such as user testing and those that involve what is done in the industry to enhance designs.	HCI_G2
TPG9: Document experiences	Ask students to document successes and challenges that will need to be improved in decision-making and justification for a chosen process.	MG3
Guiding reflection by and among students.		
RSG1: Reflective guidelines	Provide students with guidance on how to reflect on their studies.	RP_G9
RSG2: Prior knowledge	Provide students with an opportunity to reflect on their experiences in terms of their prior knowledge and knowledge gaps by adding reflection as a key process in their learning cycle.	MG2
RSG3: Critical skills	Encourage students to critically examine their own assumptions and those of the methods they chose.	RP_G3
RSG4: Reflective Journal	Encourage students to maintain a reflective journal to become aware of their thoughts, feelings, and reactions to different situations.	RP_G15
RSG5: Reflective skills	Develop specific skills to support various reflection strategies.	RP_G18
RSG6: Problem-solving skills	Develop a set of basic skills in order to suggest possible solutions from various perspectives.	RP_G19
RSG7: Reflecting on learning	Inspire students to add reflection as a key process in their learning cycle.	RP_G20
RSG8: Description of the	Ask students to reflect on one event by	RP_G4

Guideline Code	Guideline	Reference from Tables 6.1, 6.2 6.3 and 6.4
event	describing their perceptions and not to make any judgments at this stage.	
General advice to students to improve performance.		
IPG1: Question-answer session	Establish a platform that encourages students to ask questions about the parts of the work they find challenging.	GDP1
IPG2: Students bridging the theory-practice gap	Request students to learn theory first to understand the practical component of the module.	GDP5
IPG3: Time management	Guide students on how to break down abstract tasks to manage their time by providing them with a step-by-step process.	MG5
IPG4: Research and understand the question	Request students to seek more information about the topic and understand the question before attempting to answer it.	MG1
IPG5: Attending classes	Recommend to students to attend all scheduled theory and practical classes.	GDP8
IPG6: Preparing for lecture	Ask students to prepare thoroughly for the lecture by reading the relevant section before attending.	GDP9
IPG7: Studying after lecture	Request students to review the section after the lecture before the next one.	GDP10
IPG8: Completing assigned work.	Advise students to complete all the assigned work.	GDP11
IPG9: Acquiring correct answers	Ask students to get accurate answers afterward and have a thorough understanding of them.	GDP12
Assessment strategy to promote reflection.		
ASG1: Monitoring reflection	Integrate reflection into students' work in a way that makes it possible to monitor that they engage in reflection.	RP_G7
ASG2: Evaluation standards	Develop a rubric to guide the students on how they will be assessed and to facilitate evaluation standards.	RP_G13

Guideline Code	Guideline	Reference from Tables 6.1, 6.2 6.3 and 6.4
ASG3: Detailed feedback	Provide students with detailed feedback quickly to enable them to reflect on their assessed work and to make changes for further action.	RP_G8
ASG4: Reflective practice strategy	Integrate reflective practice as a strategy to assist students in completing the work and to improve their learning.	RP_G2
Overall instructional design orientation.		
IDG1: Enhance teaching quality	Reflect on lesson outcomes and acquire a variety of knowledge bases and models for teaching.	RP_G17
IDG2: Lecture method	Teach theoretical content first for students to understand the practical component of the module, followed by practical classes in a lab.	MG4
IDG3: Presentation slides	Use presentation slides to conduct classes and give students an exercise to complete.	HCI_G9
IDG4: Persona	Play the role of the persona to represent different user characteristics for the students to understand.	HCI_G15
IDG5: Pedagogical concept	Incorporate cross-disciplinary learning environments into classroom teaching and learning.	HCI_G10
IDG6: Theory-practice gap	Incorporate practical experience based on theoretical knowledge to develop valuable industry-ready skills.	HCI_G1
IDG7: User experience	Emphasise the importance of usability and user experience to students.	HCI_G6
IDG8: Maximise students' potential learning	Customise learning by applying different strategies when teaching to accommodate individual needs.	RP_G14
IDG9: Co-teaching	Implement co-teaching to provide more hands-on support to students for their practical work.	HCI_G14
IDG10: Evaluate your own teaching	Use feedback from formative evaluation in the classroom to make adjustments for further action.	RP_G16
IDG11: Hybrid classes	Encourage students to attend theory classes	HCI_G11

Guideline Code	Guideline	Reference from Tables 6.1, 6.2 6.3 and 6.4
	online or face-to-face.	
IDG12: Online learning environments	Give students the opportunity to learn more effectively by interacting, collaborating, and taking responsibility for their learning through online learning environments.	HCI_G12

Guidelines were used to plan interventions in the next phase.

6.3 Action planning phase

The guidelines identified in the literature serve as the foundation for solutions to the challenges that have been identified. The role of RP is to assist in understanding and changing previous life experiences by providing crucial insights into how individuals' ideas and experiences work (Geng *et al.*, 2019). The plans are to improve the students' performance as well as to verify and improve the guidelines.

The interventions are planned to develop students as reflective practitioners using the guidelines from Table 6.5: Guidelines for developing HCI students as reflective practitioners to facilitate the process. The possible interventions are presented in Table 6.6. It should be noted that the possible interventions are not sensitive to the specific context of the institution where this study was conducted. They were presented to provide a practical implementation plan for each guideline. Several possible interventions apply to more than one guideline, and hence their recurrence. Code C1 was used to refer to AR cycle 1, and PI for possible intervention was used with the abbreviation for each category.

Table 6.6: Possible interventions (Cycle 1)

Possible intervention	Guideline reference from Table 6.5
Setting a specific assignment to bridge the theory-practice gap.	
C1TP_PI1: Demonstrate to students how to incorporate principles into their work by providing examples.	TPG1: HCI Principles and goals
C1TP_PI2: Design the practical task to prompt students to use the theoretical and design principles they have learned.	
C1TP_PI3: In the assignment, ask students to identify the principles they have used for their design.	
C1TP_PI4: Request the students to indicate the importance and benefits of incorporating the users of the system in their design.	TPG2: User's social context
C1TP_PI5: In the assignment, ask questions to help students think like users and understand user behaviour.	
C1TP_PI6: Ask students to identify the intended users and test the system with them.	
C1TP_PI7: Ask students to consider cultural, economic, political, and social circumstances that can influence users in their practice.	TPG3: External factors
C1TP_PI8: Ask students how they applied theory to practical aspects of the assignment.	TPG4: Linking theory with practice
C1TP_PI9: Ask students to link theoretical content with practice by having them identify the theoretical content needed to complete practical work and incorporate reflection into their learning.	
C1TP_PI10: Engage students during the lecture and get feedback using online tools.	
C1TP_PI11: Use the feedback to refine the next interactive lecture.	TPG5: Interactive lecture with a case study
C1TP_PI12: Ask students to summarise what has been done.	
C1TP_PI13: Have students create user profiles using different types of users and explain how they intend to meet their needs.	
C1TP_PI14: Ask students to brainstorm ideas by using different techniques to create a prototype.	TPG7: Prototyping
C1TP_PI15: Request students to develop a prototype that represents	

Possible intervention	Guideline reference from Table 6.5
the actual system.	
C1TP_PI16: Ask students to allow users to interact with and test the feasibility of the prototype they have developed.	
C1TP_PI17: Ensure that students use prototypes to gain feedback from users early in the design process.	
C1TP_PI18: Ask students to refine and iterate until their prototype is final and ready for submission.	
C1TP_PI19: Ask students to get user feedback on the usability of their prototypes by testing with the intended users.	TPG8: User testing
C1TP_PI20: Assign a reflection sheet or questionnaire to students including questions about the difficulties they experienced while completing the assignment, how they solved those difficulties, and how they would improve their work if they had additional time.	TPG9: Document experiences
C1TP_PI21: Use a reflective sheet or questionnaire to ask students to draw conclusions from their experiences and evaluate their decisions to reflect on the choices they have made.	
Guiding reflection by and among students.	
C1RS_PI1: Use a reflective sheet or questionnaire to ask students to identify areas for improvement after providing detailed feedback on their assessed work.	RSG1: Reflective guidelines
C1RS_PI2: Use a reflective sheet or questionnaire to get students be involved in a process of self-inquiry to make connections about what they have learned in theory to apply in practice.	
C1RS_PI3: After reflecting, ask the students to formulate and write a plan on how they are going to apply what they have learned.	
C1RS_PI4: Establish realistic learning goals with your students and ask them to reflect on their progress on a regular base.	
C1RS_PI5: Give students a reflective sheet to incorporate reflection into their learning cycle to assess their prior knowledge and identify knowledge gaps.	RSG2: Prior knowledge
C1RS_PI6: Ask students to examine how the new information fits in with what they already know.	

Possible intervention	Guideline reference from Table 6.5
C1RS_PI7: Create a scenario where students can practice making decisions.	RSG3: Critical skills
C1RS_PI8: Give an assignment that will require students to identify a problem and propose a solution.	
C1RS_PI9: Organise group discussions for students to demonstrate their ability to construct knowledge.	
C1RS_PI10: Encourage students to keep journals or portfolios in which they can reflect on their challenges and learning experiences for personal development.	RSG4: Reflective Journal
C1RS_PI11: Provide students with guided reflection questions on a reflective sheet.	RSG5: Reflective skills
C1RS_PI12: Ask students to observe their thoughts to improve their work.	
C1RS_PI13: Remind students that reflection is an ongoing process.	
C1RS_PI14: Ask students to brainstorm possible solutions to their problems.	RSG6: Problem-solving skills
C1RS_PI15: Having generated many possible solutions, ask students to evaluate the advantages and disadvantages of each.	
C1RS_PI16: Ask students how they are going to apply what they learned in real-life situations.	RSG7: Reflecting on learning
C1RS_PI17: Ask students to create a strategy for how they will adjust their learning based on their understanding and challenges.	
C1RS_PI18: Ask the students to reflect on their first impressions of the assignment and share them with the instructor.	ASG2: Description of the event
General advice to students to improve performance.	
C1IP_PI1: During the lesson, ask students to identify areas they do not understand and ask questions about them.	IPG1: Question-answer session
C1IP_PI2: Set up a separate time for students to consult the Lecturer outside normal class time.	
C1IP_PI3: Ask students to address practical challenges they observe in the community they live in by applying what they have learned in	IPG2: Students bridging the theory-practice gap

Possible intervention	Guideline reference from Table 6.5
the HCI module.	
C1IP_PI4: Ask students to examine theoretical content they have learned previously so they can apply it to their practical assignments.	
C1IP_PI5: Request students to utilise the schedule in the study guide as a model for managing their time efficiently.	
C1IP_PI6: Provide a timeline of when tasks should be completed and set time frames.	IPG3: Time management
C1IP_PI7: Instruct students on how to identify objectives and divide the task into smaller, more achievable sections.	
C1IP_PI8: Ask students to structure how they are planning to complete the tasks.	
C1IP_PI9: Ask students to familiarise themselves with the question by reading it several times before attempting to answer it.	
C1IP_PI10: Develop the students' research skills by giving them work that will require researched information.	IPG4: Research and understand the question
C1IP_PI11: Ask students to use reputable sources when conducting research on the Internet.	
C1IP_PI12: Advise students to regularly attend classes to avoid missing any important information.	
C1IP_PI13: Request students to prepare any necessary text before coming to class.	IPG5: Attending classes
C1IP_PI14: Encourage students to review the material while the lesson is still fresh in their minds.	IPG6: Preparing for lecture
C1IP_PI15: Instruct students to complete their assignments in order to avoid missing opportunities for learning and improving their grades.	IPG7: Studying after lecture
C1IP_PI16: Request that students acquire accurate responses after being given their graded assignments.	IPG8: Completing assigned work.
	IPG9: Acquiring correct answers
Assessment strategy to promote reflection.	

Possible intervention	Guideline reference from Table 6.5
C1AS_PI1: Develop a case study that allows monitoring of students' progress and allows them to demonstrate their understanding of the current work.	ASG1: Monitoring student's reflection
C1AS_PI2: Use a reflective sheet or questionnaire to engage students in reflective questions about their work and the process they undertook.	
C1AS_PI3: Provide students with a rubric along with the assignment to assist them with what is expected and how their work was assessed.	ASG2: Evaluation standards
C1AS_PI4: Use a rubric for evaluation to demonstrate achievement requirements for the students.	
C1AS_PI5: Give students feedback on their progress and encourage them to reflect on their work.	ASG3: Detailed feedback
C1AS_PI6: Use formative assessments (quizzes, tests, etc.) to provide feedback on learning.	
C1AS_PI7: Encourage students to incorporate reflection into their academic activities by regularly reflecting on their work.	ASG4: Reflective practice strategy
Overall instructional design orientation.	
C1ID_PI1: Integrate activities that are enjoyable and engaging (interactive games, role-playing scenarios, and group projects) into students' work.	IDG1: Enhance teaching quality
C1ID_PI2: Conduct theoretical lessons to foster the culture of learning theoretical content first to gain an understanding of the practical work.	IDG2: Lecture method
C1ID_PI3: Use presentation slides to direct the lecture to assist students in following the lesson.	IDG3: Presentation slides
C1ID_PI4: Use presentation slides to provide context for students to understand instead of relying on them as the sole source of notes.	
C1ID_PI5: Provide a description of the persona's function and context.	IDG4: Persona
C1ID_PI6: Create a narrative that depicts how the persona interacts with the product.	

Possible intervention	Guideline reference from Table 6.5
C1ID_P17: Construct a dialogue to assist students in understanding and relating to the persona.	
C1ID_P18: Create cross-disciplinary learning settings for students to broaden their knowledge base and deepen their understanding of the application of design principles to various fields.	IDG5: Pedagogical concept
C1ID_P19: Provide practical skills for students to apply theoretical concepts to real-life situations through practical activities.	IDG6: Theory-practice gap
C1ID_P110: Give students a new assignment to perform as an assignment based on the work that they were taught recently.	
C1ID_P111: Teach the students about the benefits of user experience for products.	IDG7: User experience
C1ID_P112: Encourage students to incorporate user involvement as early as possible in the design process.	
C1ID_P113: Request that students perform usability testing on their designs in order to gather user feedback for the purpose of making improvements.	
C1ID_P114: Adapt your teaching approach to suit the needs of diverse learners and maximize their potential.	IDG8: Maximise students' potential learning
C1ID_P115: Implement co-teaching to ensure that all students receive the necessary support and individual attention.	IDG9: Co-teaching
C1ID_P116: Maintain a consistent understanding of the material and the strategies being taught.	
C1ID_P117: Assign responsibilities and workloads.	
C1ID_P118: Assess students together.	
C1ID_P119: Consider both the achievements and obstacles in order to identify opportunities to enhance student learning.	IDG10: Evaluate your own teaching
C1ID_P120: Improve teaching methods to keep up with the evolving educational requirements of students.	
C1ID_P121: Assess the impact of your changes against your learning objectives.	
C1ID_P122: Offer students the option to learn in an online or in-	IDG11: Hybrid classes

Possible intervention	Guideline reference from Table 6.5
person setting to accommodate their learning style.	
C1ID_PI23: Incorporate a learning management system (LMS) for online teaching and learning.	IDG12: Online environments
C1ID_PI24: Provide students with access to resources such as videos, tutorials, and presentations.	
C1ID_PI25: Encourage collaboration among students by giving them group work that counts towards their final mark.	
C1ID_PI26: Record lectures for students to access them when needed.	

The next step was to conduct planned interventions in the context of the environment in which this study was conducted.

6.4 Action taking phase

This study intends to develop HCI students into reflective practitioners by formulating guidelines to facilitate this process. Each week, theoretical classes were presented and recorded before the student-led practical sessions. Various topics were covered in the theoretical lectures, including an overview of HCI, human capabilities, content, visual organisation, and knowing your user. Theoretical classes were presented online due to the lockdown regulations imposed by South African government during the COVID-19 pandemic, when no face-to-face lessons were held. Instead, classes were presented online using the Microsoft Teams software package. All classes were then recorded and made available to the students to access via eThuto. During the student-led practical sessions, the students followed the videos provided on eThuto and the videos they downloaded from the internet to accomplish practical activities.

Throughout the semester, the recommendations suggested by the previous year's group during the diagnosis cycle were presented to the students during the theory classes as part of the intervention. Intervention discussions took place after the presentation of the lesson between the lecturer and students on how the students could incorporate the recommendations into their work. This took place before they

began the assignment. A special class was held focusing on following the recommendations, with the aim of encouraging students to use the recommendations during assessments.

Discussions regarding RP were integrated into theoretical classes based on the findings from the diagnosis (Chapter 3) and the literature (Chapters 4 and 5).

Following the discussions, the students were given an assignment as planned. Students were required to design a banner for the HCI to be used in the LMS. The students were also asked to specify the goals of the HCI that they intended to apply to their work and state the reason for their choice. The first step was to design a prototype of the logo they were planning to design using Pencil Project software. The next step was to design a banner in line with the specified HCI goals and the prototype that they had created.

Thereafter, they completed reflective sheets to reflect on their experiences with the assignments they had submitted.

The interventions were developed from possible interventions, sensitive to the context and restrictions in the specific context of this research project at the Central University of Technology, Free State (CUT, FS) in South Africa. Interventions were performed as described in Table 6.7. Code C1 for AR Cycle 1 and AI for actual intervention were combined and used.

Table 6.7: Actual intervention (Cycle 1)

Actual intervention	Possible intervention reference from Table 6.6
Setting a specific assignment to bridge the theory-practice gap.	
C1TP_AI1: HCI principles were taught, and examples were made to the students on how to incorporate them into the practical work.	C1TP_PI1
C1TP_AI2: Students were asked to identify users of the system in the assignment.	C1TP_PI6
C1TP_AI3: Students were made aware of the different social conditions of	C1TP_PI7

Actual intervention	Possible intervention reference from Table 6.6
the users to consider.	
C1TP_AI4: A case study of designing a banner to use on eThuto for the HCI module was provided that required the students to create a banner and demonstrate their understanding of the current work.	C1TP_PI8
C1TP_AI5: Students were requested to brainstorm and sketch out their ideas.	C1TP_PI14
C1TP_AI6: Students were given an assignment that required them to create a prototype.	C1TP_PI15
C1TP_AI7: Students were advised to refine and iterate until the prototype was final and ready for submission.	C1TP_PI18
C1TP_AI8: Students were required to identify the HCI theoretical content they used in their assignment.	C1TP_PI3
Guiding reflection by and among students.	
C1RS_AI1: Students were involved in a task that allowed them to do self-inquiry by making connections about what they had learned in theory to apply in practice.	C1RS_PI2
C1RS_AI2: Students were asked to indicate how they applied what they had learned in theory to practice.	C1RS_PI3
C1RS_AI3: In the reflective sheet, students were asked to identify the theoretical work that related to the assignment they were completing.	C1TP_PI9
General advice to students to improve performance.	
C1IP_AI1: Students were reminded to follow the guidelines stated in the study guide for the assessments. CUT (2021:8) manual states <i>“Read the question carefully; make sure you know what is being asked.”</i>	C1IP_PI9
C1IP_AI2: Students were made aware to take note of the specifics of what they were being asked.	C1IP_PI9
C1IP_AI3: Students were requested to follow the schedule provided in the study guide.	C1IP_PI5
C1IP_AI4: Activities that encourage students to conduct research about the	C1IP_PI10

Actual intervention	Possible intervention reference from Table 6.6
work that they are doing were incorporated into the module in the form of an assignment.	
C1IP_AI5: The due date was announced during class and also stipulated in the assignment.	C1IP_PI6
C1IP_AI6: Students were requested to use reputable sources when researching.	C1IP_PI11
C1IP_AI7: The lecturer allowed students who are unable to come to campus to contact her via WhatsApp and email.	C1IP_PI2
C1IP_AI8: The lecturer was available for a face-to-face consultation on days the students had practical classes on campus (Tuesdays, Wednesdays, and Thursdays).	C1IP_PI2
Assessment strategy to promote reflection.	
C1AS_AI1: Students were provided with a rubric to guide them on how they were going to be assessed.	C1AS_PI3; C1AS_PI4
C1AS_AI2: Use formative assessments (quizzes, tests, etc.) to provide feedback on learning.	C1AS_PI6
C1AS_AI3: Detailed feedback was provided to the students to assist them in areas that needed improvement.	C1AS_PI5
C1AS_AI4: Students were requested to complete the reflective sheets after receiving feedback on their work.	C1AS_PI2
C1AS_AI5: Students were advised to regularly reflect on their work.	C1AS_PI7
Overall instructional design orientation.	
IDAI1: Lessons were related to the real-life experience that the students were able to relate to what they know.	C1ID_PI9
IDAI2: Lectures were recorded to allow students to access the session as needed.	C1ID_PI26
IDAI3: The students who were unable to attend due to a variety of circumstances were able to access the session at any time.	C1ID_PI24; C1ID_PI26
IDAI4: Students were given a practical activity to apply and gain a better	ID_P9; C1ID_PI0

Actual intervention	Possible intervention reference from Table 6.6
understanding of the theoretical content they were taught.	
IDAI5: eThuto was used for students to access module content such as class presentations, tests, assignments, and classes.	C1ID_PI23

The next section presents an evaluation of the collected data.

6.5 Evaluation phase

The purpose of the evaluation phase was to investigate the suitability of the guidelines that had been developed. Students' data were obtained using a reflective sheet to test the guidelines. This evaluation report included participants' biographical information and data analysis. The perspectives of the students and the lecturer are analysed and discussed, and conclusions are presented below.

6.5.1 Participants' biographical details

The participants in this evaluation phase included those who were registered for the Graphical User Interface Design module after the diagnosis section in Chapter 3 was completed. In total, 183 students (30 repeaters) were registered for the module. The class consisted of three groups. The first group consisted of 121 students (*18 repeaters*) who were enrolled in the Diploma in Information Technology and were enrolled in the module in their second year of study. The second group consisted of 54 students (*four repeaters*) registered for the extended program. The final group comprised eight third-year students (eight repeaters) who were registered for the phased-out National Diploma in Information Technology and were participating in the module as a year module. The students' ages ranged from 19 to 34 years, with 111 males and 73 females.

All students who completed the assignment were invited to participate in the study, and since it was voluntary, only 24 students (13%) participated in this cycle. The participants were asked to complete reflective sheets. The group consisted of 15 participants aged 19 to 23 years and nine participants aged 25 to 29 years. Table 6.8

presents the profiles of the 24 participants during this cycle in terms of age, gender, and whether they repeated the module. The data indicated that 16 females and eight males participated during this cycle.

The data also demonstrated that three participants repeated the module, and 21 students took the module for the first time. Only one repeater, assigned ptp24 in Chapter 3, participated in the diagnosis phase. The participant was assigned the pseudonym ptp19 during this cycle.

Table 6.8: Participants' profiles

Ages	Gender	Participants	Repeaters	Total
19 – 23	F	<i>ptp4, ptp7, ptp9, ptp11, ptp12, ptp13, ptp15, ptp21, ptp22, ptp23</i>	<i>ptp24</i>	10
19 – 23	M	<i>ptp2, ptp3, ptp6, ptp14, ptp24</i>		5
24 – 29	F	<i>ptp5, ptp10, ptp17, ptp18, ptp20</i>	<i>ptp16</i>	6
24 – 29	M	<i>ptp8, ptp19</i>	<i>ptp1</i>	3
Total				24

The data collection technique is described in the next section.

6.5.2 Data collection

All participating students were provided with a reflective sheet to reflect on their perceptions of how theoretical sections relate to practical activities. A few broad questions were asked to determine whether the theoretical content was helpful in completing practical projects.

As part of the assignment, students were required to design a banner for the Graphic Design module to be used on eThuto, as described in Section 6.4. Students were given a rubric to assist them in understanding how their work would be assessed and

to guide them on what they were required to do. The assignment was posted and submitted on eThuto.

The participating students completed the reflective sheets after receiving feedback on their assignments. A notice was posted on eThuto, requesting students to participate. A link was provided to access the reflective sheet online. The reflective sheet included open-ended questions which did not restrict the students on the length of their answers. Reflective sheets were made available on 09 September 2021. The last student to participate completed a reflective sheet on 15 September 2021. The first semester ended in September because of the COVID-19 lockdown.

A QuestionPro online survey was used to collect data. Data were collected from the participants as part of the research to develop guidelines for the application of Reflective Practice theoretical content in developing human-computer interaction (HCI) students as reflective practitioners. The participants are known to the researcher, but their identities are not mentioned in the study, as indicated in the ethics section in Chapter 2. The next section presents how data were analysed.

6.5.3 Data Analysis

The data were analysed using conventional content analysis, as described in Section 3.4.4. This was performed by inspecting the responses and assigning codes. The categories identified in the data were used to discuss the results. The first step was to prepare the data to ensure that they were in the correct format.

6.5.3.1 Preparing the data

The data collected were already an electronic file in text format and were prepared for use in Atlas.ti.

6.5.3.2 Defining the unit of analysis

To describe the data, the unit of analysis is based on each response to the question. The respondents were asked the same questions using reflective sheets. An in-depth analysis of each response was conducted, followed by extensive interpretation of the data. Categories and coding schemes were developed by defining the units of analysis. To obtain a better perspective on the answers, the fundamental principle of the hermeneutic cycle is described in Section 3.4.4.2.

6.5.3.3 Developing categories and coding consistency

The codes were used to offer a brief explanation of the data, and categories were formed to provide significance to the codes. Codes that contribute to the same context or meaning were grouped into categories. A sample of one of the categories formed during the analysis is shown in Figure 6.1.

	Name	Grounded	Groups
☐	Conducted research		4 [Problem-solving]
☐	Contacted the Lecturer		1 [Problem-solving]
☐	Invalid solution		1 [Problem-solving]
☐	Negative answer		2 [Problem-solving]
☐	No solution		1 [Problem-solving]
☐	Reading the instruction carefully		1 [Problem-solving]
☐	Referred to theoretical content		1 [Problem-solving]
☐	Study theoretical content		8 [Problem-solving]
☐	Used Internet		6 [Problem-solving]
☐	Used notes		3 [Problem-solving]
☐	Used other resources		1 [Problem-solving]
☐	Used own ideas		1 [Problem-solving]
☐	Used previous questions papers		1 [Problem-solving]
☐	Watched YouTube		4 [Problem-solving]

Figure 6.1: Display of problem-solving category

6.5.3.4 Testing the coding scheme on a sample

Code extract 7.1: What did you do to solve your problems?

Response	Code
<i>ptp08: Had to research further by acquiring relevant content information</i>	Conducted research
<i>ptp07: Contacted the lecturer for clarification and also referred to my notes</i>	Contacted the Lecturer Used notes
<i>ptp11: I tried the best I can to answer the questions and use slides to try to understand the content</i>	Study theoretical content

As per the information from the code extract provided by Respondent 08 (*rpt08*), the student had to conduct research to acquire the information needed to solve the problem they encountered, hence the code “*Conducted research*” was assigned to the data. All texts had to be coded once the coding system had been tested on a sample.

6.5.3.5 Coding all text

Codes were created based on the data supplied by the participants. The complete text was coded by giving a code to each response. Each data item was evaluated to determine the code that best described it. Categories were generated on the basis of the patterns identified in the codes. The entire text was coded as indicated in Figure 6.2, and it is presented alphabetically according to the categories.

	Name	Grounded	Groups	
○	◇ Identifying HCI goals		2	[Challenging parts]
○	◇ No challenge		1	[Challenging parts]
○	◇ Differentiating images		1	[Challenging parts]
○	◇ Identifying users		4	[Challenging parts]
○	◇ Saving images		1	[Challenging parts]
○	◇ Designing logo		1	[Challenging parts]
○	◇ Creating banner		6	[Challenging parts]
○	◇ Understanding the requirements		1	[Challenging parts]
○	◇ Invalid challenge		4	[Challenging parts]
○	◇ Using software		3	[Challenging parts]
○	◇ Studying simplify content		1	[Lessons learned]
○	◇ Study module content		1	[Lessons learned]
○	◇ Website requirements		1	[Lessons learned]
○	◇ Benefits of a website		1	[Lessons learned]
○	◇ Manage own studies		1	[Lessons learned]
○	◇ Plan design first		2	[Lessons learned]
○	◇ Available planning softwares		1	[Lessons learned]
○	◇ Develop fresh perspective		1	[Lessons learned]
○	◇ Time management		2	[Lessons learned]
○	◇ Align plan with design		1	[Lessons learned]
○	◇ Reference theory always		1	[Lessons learned]
○	◇ Attend classes		3	[Lessons learned]
○	◇ Read theoretical content		1	[Lessons learned]
○	◇ Video tutorials not in-depth		1	[Lessons learned]
○	◇ Understand module content		3	[Lessons learned]
○	◇ Design look importance		1	[Lessons learned]
○	◇ Module needs face-to-face classes		1	[Lessons learned]
○	◇ Lessons learned not clear		3	[Lessons learned]
○	◇ Understand specifications		2	[Lessons learned]
○	◇ Researched more		5	[New strategy]
○	◇ Understand theoretical content first		2	[New strategy]
○	◇ Finish assignment		1	[New strategy]
○	◇ Watch videos		1	[New strategy]
○	◇ Create notes		1	[New strategy]
○	◇ Ask theoretical content related ques...		1	[New strategy]
○	◇ Nothing to change		5	[New strategy]
○	◇ Improve answers		5	[New strategy]

	Name	Grounded	Groups
○	◇ Ask for assistance		1 [New strategy]
○	◇ Invalid strategy		1 [New strategy]
○	◇ Create better design		1 [New strategy]
○	◇ Theoretical content not helpful		5 [Practicality of the theory]
○	◇ Theoretical content helpful		19 [Practicality of the theory]
○	◇ Reading the instruction carefully		1 [Problem-solving]
○	◇ Used other resources		1 [Problem-solving]
○	◇ Study theoretical content		8 [Problem-solving]
○	◇ Used own ideas		1 [Problem-solving]
○	◇ Watched YouTube		4 [Problem-solving]
○	◇ Used Internet		6 [Problem-solving]
○	◇ No solution		1 [Problem-solving]
○	◇ Used previous questions papers		1 [Problem-solving]
○	◇ Referred to theoretical content		1 [Problem-solving]
○	◇ Conducted research		4 [Problem-solving]
○	◇ Invalid solution		1 [Problem-solving]
○	◇ Contacted the Lecturer		1 [Problem-solving]
○	◇ Negative answer		2 [Problem-solving]
○	◇ Used notes		3 [Problem-solving]
○	◇ Related theory content not clear		3 [Related theoretical content used]
○	◇ HCI goals theory		1 [Related theoretical content used]
○	◇ Navigation systems' theory		1 [Related theoretical content used]
○	◇ Know your users theory		2 [Related theoretical content used]
○	◇ Visual organizations theoretical con...		3 [Related theoretical content used]
○	◇ User centered theoretical content		1 [Related theoretical content used]
○	◇ Several theoretical content used		5 [Related theoretical content used]
○	◇ Capabilities of human beings theor...		2 [Related theoretical content used]
○	◇ No theoretical content used		5 [Related theoretical content used]
○	◇ Content organisation		1 [Related theoretical content used]

Figure 6.2: Coding all text

6.5.3.6 Assessing consistency

Coding was carefully reviewed for correctness by repeating it twice. The process was applied to each response to check whether the code was suitable for the data item. Where revisions were required, they were implemented immediately to ensure that no code was skipped during the process. The next section presents the conclusions drawn from the data.

6.5.4 Drawing conclusions from the data

This phase entailed making sense of all recognised categories. The researcher determined the key categories reflected in the data. Each category was examined to obtain the meaning from the data. From the data collected, six categories were established to help with the research goal: *challenging parts*, *problem-solving*, *related theory content used*, *practicality of the theoretical content*, *lessons learned*, and *new strategy*. These categories are discussed in the following subsections.

6.5.4.1 Challenging parts category

In this section, participants were asked to identify the challenging parts they encountered while completing the assignment. The purpose of this question was to determine whether the work presented a challenge to students. This was done to get a sense of how the participants felt about the obstacles they faced while working on their assignments. The category *challenging parts* emerged from this question. Different responses were provided and coded accordingly, as shown in Table 6.9.

Table 6.9: Summary of Challenging parts category codes

Code No.	Code	Frequency
1.	Creating banner	6
2.	Identifying users	4
3.	Using software	3
4.	Identifying HCI goals	2
5.	Understanding the requirements	1
6.	Designing logo	1
7.	Saving images	1
8.	Differentiating images	1
9.	No challenge	1

Participants listed the different challenges they encountered, which can be summarised as follows:

- HCI participants found the work challenging when they did not know where to begin. *“When I was supposed to create a banner because I didn’t know where to start” (ptp01).*
- The work was challenging for the participants because they were doing it for the first time. *“I find the banner part challenging for me as it was my first time coming across such a project” (ptp16).*
- The participants found the work challenging because they did not use the prescribed software. *“Using software (Adobe Photoshop)” (ptp4).*
- When participants did not understand the requirements of the work, the task became challenging. *“Understanding what really was required of me to do” (ptp07).*
- The participants found the work challenging if they did not know what the work was all about. *“I did know what Banner is” (ptp02).*
- Seeking help was seen as an option by the participants to understand the challenging sections of the work. *“Yes, I would’ve asked for assistance from people or the lecture” (ptp22).*

The findings indicated that when participants did the assignment, they encountered problems related to the processes and methods involved. The next section presents how participants solved the problems they experienced with their assignments.

6.5.4.2 Problem-solving category

The question addressed in this section is a follow-up to the preceding one and sought to learn how the participants overcame the difficulties they mentioned. Participants were asked what they did to solve the problem. This provided the participants with an opportunity to reflect on the actions they took to overcome the problems they encountered. The participants indicated that they used theoretical content to solve these problems. Different responses were provided and coded accordingly, as shown in Table 6.10.

Table 6.10: Summary of Problem-solving category codes

Code No.	Code	Frequency
1.	Study theoretical content	8
2.	Used Internet	6
3.	Watched YouTube	4
4.	Conducted research	4
5.	Used notes	3
6.	Used own ideas	1
7.	Contacted the Lecturer	1
8.	Read the instructions carefully	1
9.	Referred to theoretical content	1
10.	Used previous questions papers	1

The problem-solving categories for the HCI participants can be summarised as follows:

- The participants used the Internet and YouTube to find examples of what they could do to address their difficulties. *“I went through the internet to get an example of how banners are designed. Also watched YouTube videos to create my banner”* (ptp02; *“Make research and watch videos on YouTube and creating a banner based on the goal of HCI”* (ptp04).
- HCI participants mentioned that they contacted the lecturer to clarify the sections that they did not understand and also referred to the notes as part of the problem-solving technique. *“Contacted the lecturer for clarification and also referred to my notes”* (ptp07).
- Some participants mentioned that they used theoretical content slides to understand the content, and this assisted them in solving the challenges they encountered. *“I tried the best I can to answer the questions and use slides to try to understand the content”* (ptp11); *“I went through the slides that were provided on eThuto”* (ptp16).

- HCI participants mentioned that going through the study material helped them find answers for the assignment. *“Gathered all my studying tools go through them until I find the answers” (ptp12).*
- The perceived difficulty of the assignment was cited as the primary cause for participants to abandon it. *“I left it because I didn't know what to do and I spent hours trying to figure it out” (ptp14).*
- Some participants indicated that reading the instructions carefully contributed to the successful execution of assignments. *“I just read the instructions carefully” (ptp23).*

Participants provided different responses regarding how they solved the problems they encountered while working on the assignment they were given. They described the steps they took to tackle the difficulties encountered. The next section discusses the theoretical content used by the participants to complete the assignment.

6.5.4.3 Related theoretical content used category

The aim was to determine whether participants utilised the theoretical content taught during the assignment completion process. Participants were asked which theoretical content they found relevant to the problems they were dealing with. Their responses indicated some of the theoretical content they used to complete the work. Other participants' responses were general and not distinct in terms of the theoretical content used. A summary of the codes is presented in Table 6.11.

Table 6.11: Summary of the related theoretical content used category codes

Code No.	Code	Frequency
1.	Diverse theoretical content used	5
2.	No theoretical content used	5
3.	Visual organisations theoretical content	3
4.	Related theory content not clear	3
5.	Know your users' theoretical content	2
6.	Capabilities of human beings'	2

Code No.	Code	Frequency
	theoretical content	
7.	User-centred theoretical content	1
8.	HCI goals theoretical content	1
9.	Navigation systems' theoretical content	1
10.	Content organisation	1

The related theory content used by HCI participants can be summarised as follows:

- One participant did not mention the specific theoretical content used but went through the presentation slides to find the required information. *“I had to go back to my slides for more information” (ptp06).*
- Another participant used theoretical work from the Content Organisation section to organise his content. *“One of structural organisation and organisational schemes” (ptp08).*
- The participants highlighted that identifying the actual users of the system was challenging. *“Know thy user, this content is quite challenging to me. I do study and use review questions but still, relating theory is lacking” (ptp11).*
- The HCI participants realised that the theoretical content addressed during classes was linked to the problems they encountered with the assignment. *“All the theory that we did up to so far, I find it relating to my problems” (ptp16).*
- Participants used the Internet instead of the specified module content to obtain research solutions to the problems they encountered. *“I related my problems to Google” (ptp19).*

The lessons learned in this section indicated that the participants applied theoretical content to complete the assignment. The next section discusses the practicality of the theoretical content of the assignment.

6.5.4.4 The practicality of the theoretical content category

In this section, the participants were required to state their opinions regarding the practicality of theoretical content during the process of completing practical work. They were asked whether applying the theoretical content to their problems helped them. Various opinions were offered on how the theoretical content aided them in completing practical assignments. Different responses were provided and coded accordingly, as shown in Table 6.12.

Table 6.12: Summary of responses regarding practicality of the theoretical content category codes

Code No.	Code	Frequency
1.	Theoretical content helpful	19
2.	Theoretical content not helpful	5

The responses of the HCI participants regarding the practicality of the theoretical content category can be summarised as follows:

- The participants' responses indicated that the theoretical component of the module assisted them in understanding the requirements of the assignment. *"Yes, it helped me understand the content better and therefore be able to do the assignment" (ptp07).*
- The participants realised that the theoretical component could assist them with information that made the practical component easy to implement. *"It shed light on what is needed to implement a user-friendly website" (ptp08).*
- The participants acknowledged that the module's theoretical component enabled them to perceive their work through a new lens. *"It really helps a lot because it made me look at things from a different angle" (ptp16).*
- HCI participants recognised the significance of knowing the characteristics of their users before designing the system. *"Yes. I have learned how important it is to understand the users before creating your website" (ptp17).*

- They also observed that theoretical content helped them overcome the challenges they faced while completing the assignment. *“Yes, I was able to understand how to tackle the problem” (ptp20).*
- Participants realised that the theoretical content simplified the practical component of the assignment. *“Yes, it helped me get my answers easier” (ptp21).*
- Participants discovered that reading theoretical content could provide solutions because it contained useful information. *“Yes, the textbook has more information than we think and if we actually give ourselves time to read through it then we find what we need” (ptp23).*
- The participants recognised that comprehending theoretical content was not as simple as one might believe, and that implementing it practically might be challenging. *“No, I didn’t understand much about the theory and how to apply it correctly” (ptp14).*

What was clear from the responses from the participants in this section was that they were able to identify the significance of the theoretical content in their practical work. The results demonstrated the relevance of the theoretical content to the assignment they had completed. The next section presents the lessons learned from the assignment.

6.5.4.5 Lessons learned category

For the lessons learned category, the question was designed for participants to reflect on the most important lessons they had learned from the assignment they completed. This question allowed participants to highlight what they had learned after completing the assignment. The answers provided indicated that the participants not only learned the content of the module but also learned the skills they could employ in other modules or work. Different responses were provided and coded accordingly, as shown in Table 6.13.

Table 6.13: Summary of Lessons learned category codes

Code No.	Code	Frequency
1.	Attend classes	3
2.	Understand module content	3
3.	Plan design first	2
4.	Time management	2
5.	Understand specifications	2
6.	Benefits of a website	1
7.	Study module content	1
8.	Video tutorials not in-depth	1
9.	Develop fresh perspective	1
10.	Read theoretical content	1

The responses provided by the HCI participants in terms of lessons learned can be summarised as follows:

- The participants learned that they had to start with the plan before developing the design, and that they had to ask questions that would help them comprehend what needed to be done. *“To create wireframe before creating a banner” (ptp02); “I have to be creative and plan before creating anything relating to website and ask myself the question before I start to create it” (ptp04).*
- The participants realised the significance of attending classes. *“To attend online classes” (ptp20).*
- The participants realised that reading only what was of interest to them was insufficient and that they had to read all the relevant work in order to excel in their studies. *“It is that I have to keep studying and even if I don't think the content is interesting because I realized that there is content that I see interesting than others that result to me failing the content that I don't like” (ptp11).*

- There was an understanding among the participants that starting the task on time would help them avoid working under pressure, and comprehending theoretical content would help them grasp what needed to be done. *“To start my assignments in time and read thoroughly until I understand what to do” (ptp14).*
- The HCI participants understood that returning to the textbook and revising the theoretical sessions would help them understand the content. *“To always refer back to the textbook after theory classes” (ptp23).*

The significance of what the participants learned while working on the assignment was documented. Various lessons concerning the theoretical content learned and the practical skills gained were recorded. Following the lessons learned, the next section presents a new strategy for approaching assessments.

6.5.4.6 New Strategy category

In this section, participants were asked to indicate what they would have done differently if there had been more time. The question was designed to foster reflection among participants to think about new ideas to be implemented in the future by creating time for those ideas. Researching the information surfaced again from the previous cycle as a strategy they would have used if there had been more time. A summary of the coded data is presented in Table 6.14.

Table 6.14: Summary of New Strategy category codes

No.	Code	Frequency
1.	Researched more	5
2.	Improve answers	5
3.	Nothing to change	5
4.	Understand theoretical content first	2
5.	Create better design	1
6.	Invalid strategy	1
7.	Ask for assistance	1
8.	Ask theoretical content related	1

No.	Code	Frequency
	questions	
9.	Create notes	1
10.	Watch videos	1

The responses from the HCI participants in relation to the new strategy category can be summarised as follows:

- Participants realised that questioning what they read might be beneficial to them. *“Ask questions about theory notes” (ptp03).*
- They understood that their design plans had to reflect the actual design. *“Yes, I will start the whole banner afresh as now it is not so similar to my wireframe” (ptp06).*
- The HCI participants acknowledged that performing research about the work to be completed would have aided them in understanding what was necessary and finalising the assignment more efficiently. *“Yes, I would have taken time to research well and really gather information related to my assignment so as to make it beautiful and successful by applying everything that I have learned” (ptp07); “I would have done more research to understand the content and what is expected of me” (ptp20); “Yes, I could have done more research about the section or assignment” (ptp02).*
- The participants acknowledged that taking notes and watching lecture recordings aided them in completing the assignments. *“I would have made notes and also go through the videos” (ptp12).*
- They recognised that reading theoretical content would have helped them comprehend what they needed to do. *“Yes, I would restart reading my notes from scratch until I understood exactly what to do” (ptp14).*

The responses received from participants in this category indicated that they were able to recognise the actions they could take to improve their work. Considering the many solutions presented by participants for improving their work, the next section

presents the phase referred to as “specifying learning phase” in this study, which was used to assess the overall success of the intervention in bringing about change.

6.6 Specify learning phase

In this phase, the researcher examined the results of the interventions to see if any progress had been made by reflecting on the data collected. Reflections are presented for each category, beginning with the challenges that the participants experienced while completing the assignment and advancing to how they solved those problems.

6.6.1 Reflections from challenging parts category

Participants highlighted the challenges that they encountered while completing the assignment. The data were coded under the “*challenging part*” category. The aim of the question was to determine whether the participants were able to analyse their progress and identify where they had gone wrong. The responses indicated that the challenges encountered by the participants were similar because they understood the requirements of the assignment. The challenges encountered are indicated in Table 6.15 with the supporting guidelines.

Table 6.15: Supported guidelines and actions from challenging parts data

Data in support	Supported guidelines from Table 6.5	Supported actions from Table 6.7
General advice to students to improve performance.		
Participants did not understand the requirements of the assignment.	IPG4	C1IP_PI4
Participants did not know what was meant by the banner.	IPG3	No specific action
Participants indicated that they did not know where to start when doing the assignment.	IPG3	No specific action
Participants mentioned that they were encountering the work for the first time.	IPG3	No specific action
Setting a specific assignment to bridge the theory-practice gap.		

Data in support	Supported guidelines from Table 6.5	Supported actions from Table 6.7
Participants used software to create a prototype for a banner and design a logo.	TPG7	C1TP_PI15
Overall instructional design orientation.		
Students need to attend classes to not miss an opportunity to learn.	IDG111 and IDG12	C1ID_PI24

One of the most challenging aspects of reflective practice that the participants highlighted was their initial reaction when they first encountered the assignment. In this situation, reflective practice determined that some students were unprepared to undertake an assignment. In order to engage in reflective practice effectively, it is necessary to have a thorough understanding of the assignment requirements. This supports IPG4 for students to seek more information about the topic and understand the question before attempting to answer it.

According to the participants' suggestions that were covered in the diagnosis chapter (Chapter 3), one of the prerequisites was to comprehend the question before attempting to answer it. However, the information obtained was insufficient to determine if participants were following this advice and if they were aware of the shortcoming of not knowing what to do. Understanding what is required is crucial because it allows students to focus on the correct strategy when answering questions. This statement is supported by Cerdán *et al.* (2019), who asserted that students need to understand what they have been asked. From another perspective, this might imply that students are not attending student-led practical sessions and are not watching the videos that are placed on eThuto to help them with what they need to do. In future, students was asked to watch the videos once again before submitting their work to ensure that they understand the examples of work that is relevant to what they are required to complete.

The guidelines that emerged from the data on challenging parts are presented in Table 6.16.

Table 6.16: Additional possible actions from data on challenging parts

Additional possible interventions	
Possible intervention	Related guideline from Table 6.4
General advice to students to improve performance.	
C1PI1: Ensure that the students understand what is meant by the terminology in terms of the artefact.	IPG4: Research and understand the question
C1PI2: Provide the students with general advice on how to start a project.	
C1PI3: Expect the students to have a barrier against first-time activities.	IPG2: Students bridging the theory-practice gap
Setting a specific assignment to bridge the theory-practice gap.	
C1PI4: Ask students to identify areas that are still confusing to them.	TPG10: Identifying additional confusing areas: After formative assessments students should be reminded to update their reflection documents to reflect additional learning experience.
C1PI5: Ensure that the students understand the user environment.	TPG2: User's social context
Assessment strategy to promote reflection.	
C1PI6: Provide students with a reflective sheet after class for students to provide feedback for the lesson completed as part of their assignment.	ASG5: Post-lesson reflection: Provide students with a reflective sheet, allowing them to evaluate the knowledge they have gained during the lesson.

The next section presents reflections on the problem-solving category.

6.6.2 Reflections from the category on problem-solving

The question about problem-solving sought to determine what the participants did to overcome the difficulties they experienced in the difficult sections of the assignment. The participants deliberated on their actions, what they did, and their coping techniques. This included asking questions, seeking extra help, and conducting research on the Internet. *RSG7: Reflecting on learning* and *RSG6: Problem-solving*

skills were assessed. A summary of the actions taken by the participants to solve the problems they encountered is presented in Table 6.17, with supporting guidelines.

Table 6.17: Supported guidelines and actions from the problem-solving data

Data in support	Supported guidelines from Table 6.4	Supported actions from Table 6.7
General advice to students to improve performance.		
Participants studied theoretical content to understand the requirements of the question.	IPG2	C1IP_PI4
Participants used their study materials to find answers for the assignment.	IPG2	C1IP_PI4
Participants contacted the lecturer for clarity.	IPG1	C1IP_PI2
Participants read the instructions carefully to solve their problem of not answering what was asked.	IPG4	C1IP_PI9
Participants used the internet and YouTube to find answers to their problems.	IPG4	C1IP_PI10

Current and future students were encouraged to master strategies that will assist them in effectively completing assignments. Nowadays, students face information overload because of the abundance of information available on the Internet, making it difficult for them to select the appropriate content for their assignments. According to Roetzel (2019), information overload occurs when students are presented with more information than they can handle. This may lead to disappointment or dissatisfaction when students do not present the required information which results in them receiving lower grades. On the other hand, students might be in a better position to obtain better scores if they know how to find appropriate materials for their tasks.

The solutions used by the participants to tackle the problems they encountered included contacting the lecturer for clarification and carefully reading the instructions. This is significant because some of the recommendations were used to solve difficulties that emerged while working on assignments.

Occasionally, it is difficult to resolve a problem. A logical response to this difficulty is to ask the lecturer for clarification. If students are unable to contact the lecturer, they should read the instructions more than once to ensure that they understand what is required to answer the question.

The possible interventions that emerged from data analysis regarding possible actions that students can take to solve problems are presented in Table 6.18.

Table 6.18: Additional possible actions from the problem-solving data

Additional possible interventions	
Possible intervention	Related guideline from Table 6.5
Overall instructional design orientation.	
C1PI7: Prepare students for assignments by asking them to identify the main ideas in theoretical content and to think critically about what they are reading.	IDG6: Theory-practice gap
General advice to students to improve performance.	
C1PI8: For each question, ask the students to read the instructions several times to ensure they understand the requirements.	IPG4: Research and understand the question

The next section presents reflections on the related theory content category.

6.6.3 Reflections on related theory content used

The purpose of the question was to assess whether participants applied theoretical information to solve the challenges they encountered. The responses indicated that the participants used theoretical content to address the problems they encountered. Table 6.19 includes the guidelines based on the data on the application of relevant theory.

Table 6.19: Supported guideline and actions from related theory content used data

Data in support	Supported guidelines from Table 6.4	Supported actions from Table 6.7
Setting a specific assignment to bridge the theory-practice gap.		
Participants used specific theoretical content to relate to the practical assignment.	TPG4	C1TP_PI9

The literature confirmed that integrated methods for learning HCI theory should be used (Faiola, 2007). In this study, participants stated that they had to return and identify the theoretical content that was applicable to the challenges they encountered. The participants also used the Internet to solve problems. However, the information provided was inadequate to establish whether they used the relevant theoretical content or a solution unrelated to the theory. The results demonstrated that participants could recognise the link between theory and its applications to everyday activities. This application of theoretical content to practical situations is also appropriate for use in industry.

The next section presents reflections on the practicability of the theoretical content.

6.6.4 Reflections on the practicality of theoretical content

The participants were asked whether relating their problems to the theoretical content assisted them in completing the practical assignment. Different responses were provided, demonstrating that the theoretical content learned was useful in completing the assignment. A summary of the responses and supporting guidelines is presented in Table 6.20.

Table 6.20: Supported guidelines and actions from the practicality of theoretical content data

Data in support	Supported guidelines from Table 6.4	Supported actions from Table 6.7
Setting a specific assignment to bridge the theory-practice gap.		
Theory assisted the participants to understand the requirements of the assignment.	TPG4; IPG2 and IPG6	C1TP_PI9
Theory provided the participants with information that made the practical easy to implement.	TPG4	C1TP_PI9
Participants realised that theoretical content shifts one's viewpoint about the practical.	TPG4	C1TP_PI9
Theoretical content assisted the participants to overcome the difficulties they faced while they were completing the practical assignment.	TPG4	C1TP_PI9
Participants realised that theoretical content simplified practice.	TPG4	C1TP_PI9
Theoretical content provided solutions for the participants.	TPG4	C1TP_PI9
Participants realised that theory to practice may be challenging when put into practice.	TPG4	C1TP_PI9

The findings revealed the significance of theoretical content, not only for completing assignments, but also for personal growth. *TPG4: Linking theory with practice* and *IPG2: Students bridging the theory-practice gap*. Some students were able to link theory to practice.

The next section presents reflections on the category dealing with lessons learned in order to establish what the participants learned from their experience of completing the assignment.

6.6.5 Reflections on lessons learned

Participants were asked to consider the modifications they would make to the way they handled the assignment if they had additional time. The purpose of the question was to allow participants to assess where they might improve, where they had gone wrong, and how they planned to correct their mistakes. This is related to the literature on the improvements they would need to make (*TPG9: Document experiences*). Participants' responses included a wide range of issues, including planning, attending classes, studying theoretical content, time management, and revision. A summary of the participants' views on the lessons learned while completing the assignment is presented in Table 6.21 with the supporting guidelines and actions.

Table 6.21: Supported guidelines and actions from lessons learned data

Data in support	Supported guidelines from Table 6.4	Supported actions from Table 6.7
General advice to students to improve performance.		
Participants noted that they need to plan first before starting with their assignment.	IPG2	C1IP_PI8
Participants realised the significance of attending classes.	IPG5	C1IP_PI12
Participants observed that they need to read all theoretical content to excel in studies.	IPG2	C1IP_PI4
Participants also indicated that they need revise what was taught to understand the content.	IPG7	C1IP_PI14
There was an understanding among the participants that starting the task on time will enable them to go through theoretical content.	IPG3	C1IP_PI5; C1IP_PI6 and C1IP_PI8
Some participants stated that starting the task on time will help to avoid working under pressure.	IPG2	No specific action
Setting a specific assignment to bridge the theory-practice gap.		
Some participants indicated that they should begin with the plan before developing the design.	TPG7	No specific action

The data on lessons learned may benefit not only current students but also future students by improving their study techniques. The participants mentioned the techniques that worked well for them to complete the assignment and those that did not work very well. One of the skills that the students learned during this assignment was better time management. Committing to a set amount of time to work on the topic is beneficial for every student.

By documenting the lessons learned, participants were also able to assess where they had gone wrong. The next section presents reflections on the new strategy to determine other methods that could assist in completing the assignment successfully. The reflections on the new strategy category revealed what the participants would have done differently if there was more time.

The possible interventions that emerged from data analysis are presented in Table 6.22.

Table 6.22: Additional possible actions from data on lessons learned

Additional possible interventions	
Possible intervention	Related guideline from Table 6.5
Setting a specific assignment to bridge the theory-practice gap.	
C1PI9: Recommend that the students should plan their designs first, to serve as a guide throughout the process.	TPG7: Prototyping
General advice to students to improve performance.	
C1PI10: Emphasise the importance of starting the task on time to minimise distractions and procrastination.	IPG3: Time management

The next section presents reflections on this new strategy category.

6.6.6 Reflections from the new strategy category

Participants were asked what else they would have done differently if there was more time. The purpose of this reflection was to enhance knowledge and critical

thinking abilities. This question was designed to motivate participants to continually search for new strategies and information on how to complete the assignment. Their responses are indicated in Table 6.23 with the supporting guidelines and actions.

Table 6.23: Supported guidelines and actions from new strategy data

Data in support	Supported guidelines from Table 6.5	Supported actions from Table 6.7
General advice to students to improve performance.		
The devised strategy for participants to correct the mistakes was to start afresh.	IPG8: Completing assigned work.	No existing action
Another strategy to assist in completing the assignment was to take the notes.	IPG8: Completing assigned work.	No existing action
Participants mentioned that conducting research would have assisted to understand what was necessary to finalise the assignment more efficiently.	IPG4	C1IP_PI10
Guiding reflection by and among students.		
Participants noted that questioning what they read may assist them.	RSG5	C1RS_PI12
Overall instructional design orientation.		
Participants pointed out that watching lecture recordings would have assisted in completing the assignment.	IDG12	C1ID_PI24 and C1ID_PI26

An effective way to do an assignment is through constant research on the latest information related to the topic as well as through interacting with other students. The strategy of starting again suggests that students return to the beginning of the work to rectify errors and strategically answer questions to ensure success. Starting again is another technique in which information is gathered intentionally to improve the grades. This can be seen as an efficient method for ensuring that students perform better or accomplish a goal with a satisfactory grade. Another effective

strategy is taking notes to increase students' grasp of what they are studying, which can lead to better grades.

There are several possible solutions that can be used to gain knowledge on the corrections that need to be made. One method is to have students look over the lecture transcript after recording and highlight the most significant topics from the lecturer. Another method is for students to review their manuals and write notes. Students can also use both methods. Notes can be useful during the assessment period; students can review and use them as a reference to recall what they have learned.

Students should also be encouraged to watch lecture recordings after class, particularly if the material is challenging. They can benefit from watching lectures to enhance their skills and knowledge of the topic. As a result, they will be able to link their prior knowledge during class discussions and assignments. Though COVID-19 imposed a new approach, students took notes rather than attending online lectures.

The possible actions that emerged from the data analysis Their responses are indicated in Table 6.23 with the supporting guidelines and actions.

Table 6.24: Additional possible actions from new strategy data

Additional possible interventions	
Possible intervention	Related guideline from Table 6.5
General advice to students to improve performance.	
C1PI11: Motivate students to start afresh as soon as they realise that their work does not meet the specified objectives.	IPG8: Completing assigned work.
C1PI12: Encourage students to take notes while reading.	IPG7: Studying after lecture

The new strategies that emerged from this section have been added to existing recommendations. The next section presents a summary of the ***specify learning*** phase.

6.6.7 Summary of specify learning phase

In this section, actual interventions are revisited to determine whether they were successful from the lecturer's perspective. A *yes* is used for interventions that were successful, *no* for unsuccessful interventions, and *not sure* where the outcome was not clear. Where the interventions were unsuccessful, a brief explanation was given. A summary of the specified learning phases is presented in Table 6.25.

Table 6.25: Summary for specify learning phase (Cycle 1)

Actual intervention	Student's success from the Lecturer's perspective	Success in terms of guidelines
Setting a specific assignment to bridge the theory-practice gap.		
C1TP_AI1: HCI principles were taught, and examples were made to the students on how to incorporate them into the practical work.	Yes	Yes
C1TP_AI2: Students were asked to identify users of the system in the assignment.	Yes	Yes
C1TP_AI3: Students were made aware of the different social conditions of the users to consider.	Not sure	Yes
C1TP_AI4: A case study of designing a banner to use on eThuto for the HCI module was provided that required the students to create a banner and demonstrate their understanding of the current work.	No – some students did not understand what a banner is	Yes
C1TP_AI5: Students were requested to brainstorm and sketch out their ideas;	Not sure – different sketches were not requested	Yes
C1TP_AI6: Students were given an assignment that required them to create a prototype.	Yes	Yes
C1TP_AI7: Students were advised to refine and iterate until the prototype was final and ready for submission.	Not sure if the students refined their designs	Yes
C1TP_AI8: Students were required to identify the HCI theoretical content they used in their assignment.	Yes	Yes

Actual intervention	Student's success from the Lecturer's perspective	Success in terms of guidelines
Guiding reflection by and among students.		
C1RS_AI1: Students were involved in a task that allowed them to do self-inquiry by making connections about what they had learned in theory to apply in practice.	Yes	Yes
C1RS_AI2: Students were asked to indicate how they applied what they had learned.	Yes	Yes
C1RS_AI3: In the reflective sheet, students were asked to identify the theoretical work that related to the assignment they were completing.	Yes	Yes
General advice to students to improve performance.		
C1IP_AI1: Students were reminded to follow the guidelines stated in the study guide for the assessments. CUT (2021:8) manual states <i>"Read the question carefully; make sure you know what is being asked."</i>	No - some students did not understand the question	No
C1IP_AI2: Students were made aware to take note of the specifics of what they were being asked.	No – some students did not take note of what was asked	No
C1IP_AI3: Students were requested to follow the schedule provided in the study guide.	Yes	Yes
C1IP_AI4: Activities that encourage students to conduct research about the work that they are doing were incorporated into the module in the form of an assignment.	Yes	Yes
C1IP_AI5: The due date was announced during class and also stipulated in the assignment.	Yes	Yes
C1IP_AI6: Students were requested to use reputable sources when researching.	No – some students used information not related to their work from the Internet	Yes

Actual intervention	Student's success from the Lecturer's perspective	Success in terms of guidelines
C1IP_AI7: The lecturer allowed students who are unable to come to campus to contact her via WhatsApp and email.	Yes	Yes
C1IP_AI8: The lecturer was available for a face-to-face consultation on days the students had practical classes on campus (Tuesdays, Wednesdays, and Thursdays).	Yes – Some students came for consultation	Yes
Assessment strategy to promote reflection.		
C1AS_AI1: Students were provided with a rubric to guide them on how they were going to be assessed.	Not sure – Few students made use of the rubric	Yes
C1AS_AI2: Use formative assessments (quizzes, tests, etc.) to provide feedback on learning.		
C1AS_AI3: Detailed feedback was provided to the students to assist them in areas that needed improvement.	Not sure – feedback impact was not measured	Yes
C1AS_AI4: Students were requested to complete the reflective sheets after receiving feedback on their work.	Yes	Yes
C1AS_AI5: Students were advised to regularly reflect on their work.	Not sure – this was not measured	Yes
Overall instructional design orientation.		
IDAI1: Lessons were related to the real-life experience that the students were able to relate to what they know.	Yes	Yes
IDAI2: Lectures were recorded to allow students to access the session as needed.	Yes	Yes
IDAI3: The students who were unable to attend due to a variety of circumstances were able to access the session at any time.	Yes	Yes
IDAI4: Students were given a practical activity to apply	Yes	Yes

Actual intervention	Student's success from the Lecturer's perspective	Success in terms of guidelines
and gain a better understanding of the theoretical content they were taught.		
IDA15: eThuto was used for students to access module content such as class presentations, tests, assignments, and classes.	Yes	Yes

In the current AR cycle, the focus is on deriving lessons and insights related to guidelines for developing HCI students as reflective practitioners. The possible interventions emerging from this cycle are presented in Table 6.26. The code EC1PI refers to emerging cycle 1 and possible interventions are suggested.

Table 6.26: Emerging possible interventions (Cycle 1)

Additional possible interventions	
Possible intervention	Related guidelines from Table 6.4
General advice to students to improve performance.	
EC1PI1: Ensure that the students understand what is meant by the terminology in terms of the artefact.	IPG4: Research and understand the question
EC1PI2: Provide the students with general advice on how to start a project.	
EC1PI3: For each question, ask the students to read the instructions several times to ensure they understand the requirements.	
EC1PI4: Expect the students to have a barrier against first-time activities.	IPG2: Students bridging the theory-practice gap
EC1PI5: Emphasise the importance of starting the task on time to minimise distractions and procrastination.	IPG3: Time management
EC1PI6: Motivate students to start afresh as soon as they realise that their work does not meet the specified objectives.	IPG8: Completing assigned work.

Additional possible interventions	
EC1PI7: Encourage students to take notes while reading.	IPG7: Studying after lecture
Setting a specific assignment to bridge the theory-practice gap.	
EC1PI8: Recommend that the students should plan their designs first, to serve as a guide throughout the process.	TPG7: Prototyping
EC1P9: Ensure that the students understand the user environment.	TPG2: User's social context
EC1PI0: Ask students to identify areas that are still confusing to them.	TPG10: Identifying additional confusing areas
Overall instructional design orientation.	
EC1PI11: Prepare students for assignments by asking them to identify the main ideas in theoretical content and to think critically about what they are reading.	IDG6: Theory-practice gap
Assessment strategy to promote reflection.	
EC1PI12: Provide students with a reflective sheet after class for students to provide feedback for the lesson completed as part of their assignment.	ASG5: Post-lesson reflection

These possible interventions were merged with those presented in Table 6.6 in the next AR cycle (Cycle 2). The next section presents the verification of the guidelines.

6.7 Verifying guidelines (Cycle 1)

Table 6.27 gives a summary of the guidelines, which were verified to ensure their accuracy and validity. The status used is *verified* or *not verified*. The data were also checked to determine whether they need further action or not. Thus, new guidelines have been specified. The guidelines and their status are presented in Table 6.27.

Table 6.27: Guidelines for developing HCI students as reflective practitioners (Cycle1)

Guideline Code	Guideline	Status	Require further action
Setting a specific assignment to bridge the theory-practice gap.			
TPG1: HCI principles and goals	Assist students in using appropriate HCI principles and goals for the current context in their work to analyse, design, evaluate, and implement interactive systems for universal use.	Verified	Yes
TPG2: User's social context	Encourage students to incorporate reflective practices and consider the perspectives of users and their social context while creating designs and engaging with end users to broaden the scope of their research.	Not verified	Yes
TPG3: External factors	Ask students to evaluate external factors that may affect individuals and practices.	Not verified	Yes
TPG4: Linking theory with practice	Ask students to evaluate what they have learned through practice.	Verified	Yes
TPG5: Interactive lecture with a case study	Explore different ideas to make activities fun and involve the students in the learning process by assigning a case study based on theory work.	Verified	Yes
TPG6: User's role	Assist the students in developing a better understanding of the users' role in design.	Not verified	Yes
TPG7: Prototyping	Ask students to develop physical prototyping to gain specific skills.	Verified	Yes
TPG8: User testing	Ask students to integrate activities such as user testing and those that involve what is done in the industry to enhance designs.	Not verified	
TPG9: Document experiences	Ask students to document successes and challenges that will need to be improved in decision-making and justification for a chosen process.	Verified	Yes
TPG10: Identifying additional confusing areas	After formative assessments students should be reminded to update their reflection documents to reflect additional learning experience.	New	Yes

Guideline Code	Guideline	Status	Require further action
Guiding reflection by and among students.			
RSG1: Reflective guidelines	Provide students with guidance on how to reflect on their studies.	Not verified	Yes
RSG2: Prior knowledge	Provide students with an opportunity to reflect on their experiences in terms of their prior knowledge and knowledge gaps by adding reflection as a key process in their learning cycle.	Verified	Yes
RSG3: Critical skills	Encourage students to critically examine their own assumptions and those of the methods they chose.	Verified	Yes
RSG4: Reflective Journal	Encourage students to maintain a reflective journal to become aware of their thoughts, feelings, and reactions to different situations.	Not verified	Yes
RSG5: Reflective skills	Develop specific skills to support various reflection strategies.	Verified	Yes
RSG6: Problem-solving skills	Develop a set of basic skills in order to suggest possible solutions from various perspectives.	Verified	Yes
RSG7: Reflecting on learning	Inspire students to add reflection as a key process in their learning cycle.	Verified	Yes
RSG8: Description of the event	Ask students to reflect on one event by describing their perceptions and not to make any judgments at this stage.	Not verified	Yes
General advice to students to improve performance.			
IPG1: Question-answer session	Establish a platform that encourages students to ask questions about the parts of the work they find challenging.	Verified	Yes
IPG2: Students bridging the theory-practice gap	Request students to learn theory first to understand the practical component of the module.	Verified	Yes
IPG3: Time management	Guide students on how to break down abstract tasks to manage their time by providing them with a step-by-step process.	Verified	Yes
IPG4: Research and understand the question	Request students to seek more information about the topic and understand the question before attempting to answer it.	Verified	Yes

Guideline Code	Guideline	Status	Require further action
IPG5: Attending classes	Recommend to students to attend all scheduled theory and practical classes.	Verified	No
IPG6: Preparing for lecture	Ask students to prepare thoroughly for the lecture by reading the relevant section before attending.	Verified	No
IPG7: Studying after lecture	Request students to review the section after the lecture before the next one.	Verified	Yes
IPG8: Completing assigned work	Advise students to complete all the assigned work.	Verified	No
IPG9: Acquiring correct answers	Ask students to get accurate answers afterward and have a thorough understanding of them.	Not verified	Yes
Assessment strategy to promote reflection.			
ASG1: Monitoring reflection	Integrate reflection into students' work in a way that makes it possible to monitor that they engage in reflection.	Verified	No
ASG2: Evaluation standards	Develop a rubric to guide the students on how they will be assessed and to facilitate evaluation standards.	Verified	Yes
ASG3: Detailed feedback	Provide students with detailed feedback quickly to enable them to reflect on their assessed work and to make changes for further action.	Verified	Yes
ASG4: Reflective practice strategy	Integrate reflective practice as a strategy to assist students in completing the work and to improve their learning.	Not verified	Yes
ASG5: Post-lesson reflection	Provide students with a reflective sheet, allowing them to evaluate the knowledge they have gained during the lesson.	New	Yes
Overall instructional design orientation.			
IDG1: Enhance teaching quality	Reflect on lesson outcomes and acquire a variety of knowledge bases and models for teaching.	Verified	No
IDG2: Lecture method	Teach theoretical content first for students to understand the practical component of the module, followed by practical classes in a lab.	Verified	No
IDG3: Presentation slides	Use presentation slides to conduct classes and give students an exercise to complete.	Verified	No

Guideline Code	Guideline	Status	Require further action
IDG4: Persona	Play the role of the persona to represent different user characteristics for the students to understand.	Not verified	Yes
IDG5: Pedagogical concept	Incorporate cross-disciplinary learning environments into classroom teaching and learning.	Verified	Yes
IDG6: Theory-practice gap	Incorporate practical experience based on theoretical knowledge to develop valuable industry-ready skills.	Verified	Yes
IDG7: User experience	Emphasise the importance of usability and user experience to students.	Verified	No
IDG8: Maximise students' potential learning	Customise learning by applying different strategies when teaching to accommodate individual needs.	Not verified	Yes
IDG9: Co-teaching	Implement co-teaching to provide more hands-on support to students for their practical work.	Not verified	Yes
IDG10: Evaluate your own teaching	Use feedback from formative evaluation in the classroom to make adjustments for further action.	Verified	No
IDG11: Hybrid classes	Encourage students to attend theory classes online or face-to-face.	Verified	Yes
IDG12: Online learning environments	Give students the opportunity to learn more effectively by interacting, collaborating, and taking responsibility for their learning through online learning environments.	Verified	Yes

The interventions that require further action must be repeated in Cycle 2 to ensure that students develop the ability to reflect further on their work. The next section presents the limitations of AR Cycle 1.

6.8 Limitations of the First AR Cycle

In the wake of COVID-19, it has become increasingly difficult to conduct research. Online learning caused students to lose access to the physical resources found at the university, such as the computer hardware and software necessary to complete practical assignments, and they could not participate in classes and research in

physical classrooms for the HCI module. Classes for major modules were held face-to-face with a limited number of students due to the COVID regulations.

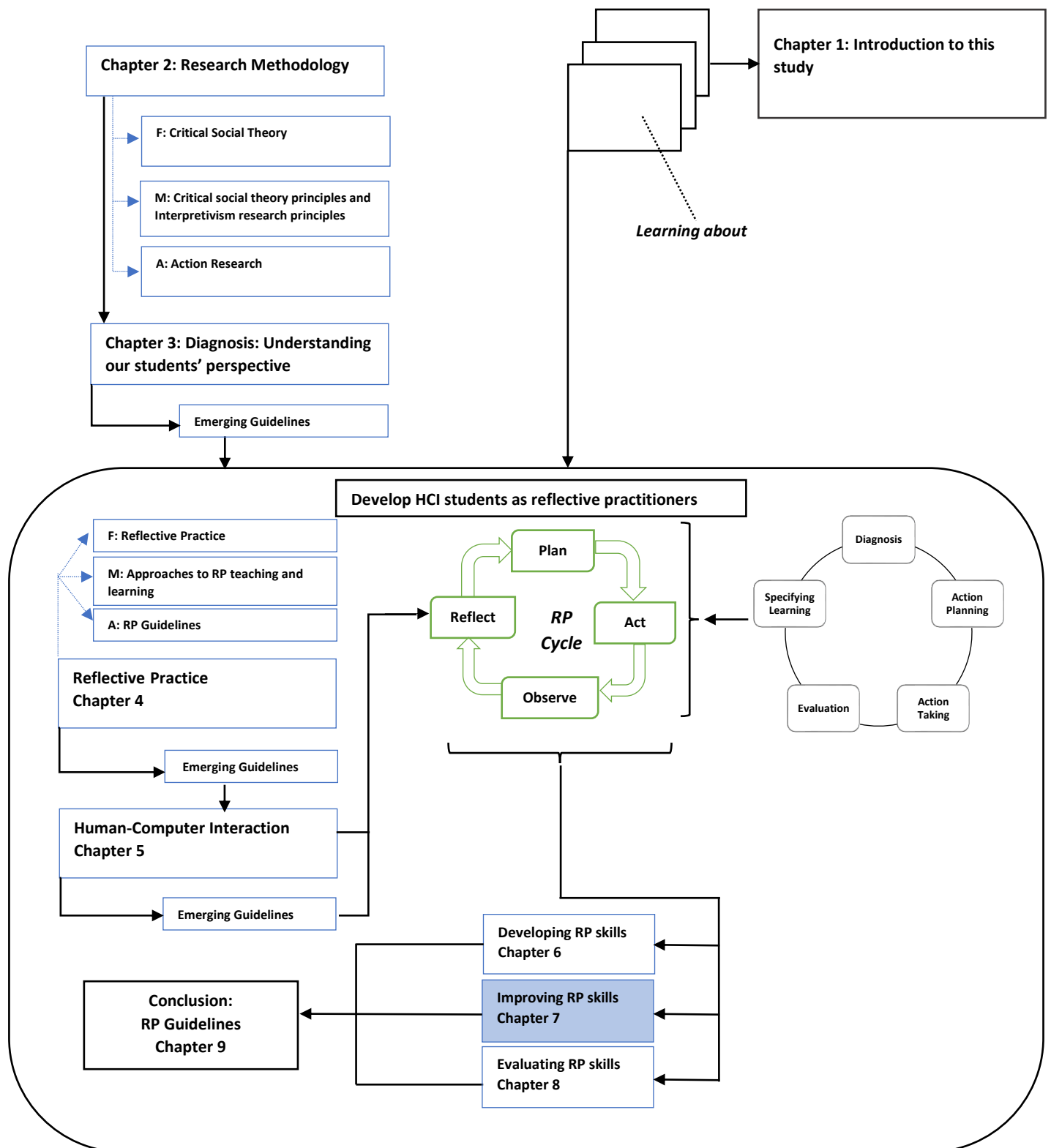
Therefore, it is necessary to find an alternative means to collect data for this AR Cycle. It is also worth noting that when online tools are used, the sample is limited to those who are willing to participate. Thus, it was difficult to obtain clear, representative results using these tools. There is a possibility that the results may have been skewed by participant bias. Therefore, when conducting research, it is critical to be aware of the limitations of online tools.

The next section presents the summary of this chapter.

6.9 Chapter summary

This chapter presented the first AR cycle as part of formulating guidelines for developing HCI students as reflective practitioners. In the diagnosis phase (Section 6.2), the guidelines that were received from the diagnosis (Chapter 3) were presented. Guidelines from the literature (Chapters 4 and 5) were also presented. The intervention strategy was developed during the action planning phase (Section 6.3) to develop students' reflective skills.

During the action-taking phase (Section 6.4), the intervention was implemented as planned. Section 6.5 presents the evaluation phase and provides an overview of the data. The data from the participants were analysed and different categories emerged from the data during the evaluation phase. Conclusions were drawn from the key categories in Section 6.5.4. Each category was reflected during the specified learning phase (Section 6.6) in terms of the recommendations or interventions that were successful. The guidelines were verified in Section 6.7, and was utilised in the following cycle. These guidelines were used as a reference to assist in developing HCI students as reflective practitioners. The chapter concluded with Section 6.8 where the limitations encountered in this first AR cycle were presented.



CHAPTER 7: IMPROVING REFLECTIVE PRACTICE SKILLS

7.1 Introduction

The primary objective of this study is to formulate guidelines for developing human-computer interaction (HCI) students as reflective practitioners. This is the second action research (AR) cycle. HCI students were guided through this second AR cycle toward developing as reflective practitioners. In Section 7.2, the diagnosis phase of the second cycle of AR is presented based on the findings of the first AR Cycle. Section 7.3 presents an action plan developed based on these findings. The action-taking phase with a specific context for this AR cycle is presented in Section 7.4. The action-taking phase is followed by the evaluation phase described in Section 7.5.

During the evaluation phase, the data were analysed using the content analysis approach described in Section 2.4.9 of the methodology chapter. Section 7.5.4 presents the findings of content analysis codes where learning was specified in accordance with reflections from each category as presented in Section 7.6. The verification of the guidelines is presented in Section 7.7. The findings will inform the next cycle of the study to develop HCI students as reflective practitioners. The limitations of the second AR cycle are presented in Section 7.8. Finally, conclusions for the chapter are presented in Section 7.2.

7.2 Diagnosis phase

The diagnosis of this cycle is based on the findings of the first AR cycle during the first semester of the module. The first cycle was based on guidelines for developing HCI students as reflective practitioners.

Table 7.1 presents the findings from the first AR Cycle (Table 6.27) which are the inputs to this cycle to assist in diagnosing challenges. The guidelines that were verified and required no further action were not repeated. The Table displays the guidelines that were verified and required further action, and those that were not verified. This Table also includes new guidelines developed after the first iteration.

Table 7.1: Guidelines requiring further action (Diagnosis Cycle 2)

Guideline Code	Guideline	Status	Require further action
Setting a specific assignment to bridge the theory-practice gap.			
TPG1: HCI principles and goals	Assist students in using appropriate HCI principles and goals for the current context in their work to analyse, design, evaluate, and implement interactive systems for universal use.	Verified	Yes
TPG2: User's social context	Encourage students to incorporate reflective practices and consider the perspectives of users and their social context while creating designs and engaging with end users to broaden the scope of their research.	Not verified	Yes
TPG3: External factors	Ask students to evaluate external factors that may affect individuals and practices.	Not verified	Yes
TPG4: Linking theory with practice	Ask students to evaluate what they have learned through practice.	Verified	Yes
TPG5: Interactive lecture with a case study	Explore different ideas to make activities fun and involve the students in the learning process by assigning a case study based on theory work.	Verified	Yes
TPG6: User's role	Assist the students in developing a better understanding of the users' role in design.	Not verified	Yes
TPG7: Prototyping	Ask students to develop physical prototyping to gain specific skills.	Verified	Yes
TPG8: User testing	Ask students to integrate activities such as user testing and those that involve what is done in the industry to enhance designs.	Not verified	Yes
TPG9: Document experiences	Ask students to document successes and challenges that will need to be improved in decision-making and justification for a chosen process.	Verified	Yes
TPG10: Identifying additional confusing areas	After formative assessments, students should be reminded to update their reflection documents to reflect additional learning experiences.	Verified	Yes

Guideline Code	Guideline	Status	Require further action
Guiding reflection by and among students.			
RSG1: Reflective guidelines	Provide students with guidance on how to reflect on their studies.	Not verified	Yes
RSG2: Prior knowledge	Provide students with an opportunity to reflect on their experiences in terms of their prior knowledge and knowledge gaps by adding reflection as a key process in their learning cycle.	Verified	Yes
RSG3: Critical skills	Encourage students to critically examine their own assumptions and those of the methods they chose.	Verified	Yes
RSG4: Reflective Journal	Encourage students to maintain a reflective journal to become aware of their thoughts, feelings, and reactions to different situations.	Not verified	Yes
RSG5: Reflective skills	Develop specific skills to support various reflection strategies.	Verified	Yes
RSG6: Problem-solving skills	Develop a set of basic skills in order to suggest possible solutions from various perspectives.	Verified	Yes
RSG7: Reflecting on learning	Inspire students to add reflection as a key process in their learning cycle.	Verified	Yes
RSG8: Description of the event	Ask students to reflect on one event by describing their perceptions and not to make any judgments at this stage.	Not verified	Yes
General advice to students to improve performance.			
IPG1: Question-answer session	Establish a platform that encourages students to ask questions about the parts of the work they find challenging.	Verified	Yes
IPG2: Students bridging the theory-practice gap	Request students to learn theory first to understand the practical component of the module.	Verified	Yes
IPG3: Time management	Guide students on how to break down abstract tasks to manage their time by providing them with a step-by-step process.	Verified	Yes
IPG4: Research and understand the question	Request students to seek more information about the topic and understand the question before attempting to answer it.	Verified	Yes

Guideline Code	Guideline	Status	Require further action
IPG7: Studying after lecture	Request students to review the section after the lecture before the next one.	Verified	Yes
IPG9: Acquiring correct answers	Ask students to get accurate answers afterwards and understand them thoroughly.	Not verified	Yes
Assessment strategy to promote reflection.			
ASG2: Evaluation standards	Develop a rubric to guide the students on how they will be assessed and to facilitate evaluation standards.	Verified	Yes
ASG3: Detailed feedback	Provide students with detailed feedback quickly to enable them to reflect on their assessed work and to make changes for further action.	Verified	Yes
ASG4: Reflective practice strategy	Integrate reflective practice as a strategy to assist students in completing the work and to improve their learning.	Not verified	Yes
ASG5: Post-lesson reflection	Provide students with a reflective sheet, allowing them to evaluate the knowledge they have gained during the lesson.	Verified	Yes
Overall instructional design orientation.			
IDG4: Persona	Play the role of the persona to represent different user characteristics for the students to understand.	Not verified	Yes
IDG5: Pedagogical concept	Incorporate cross-disciplinary learning environments into classroom teaching and learning.	Verified	Yes
IDG6: Theory-practice gap	Incorporate practical experience based on theoretical knowledge to develop valuable industry-ready skills.	Verified	Yes
IDG8: Maximise students' potential learning	Customise learning by applying different strategies when teaching to accommodate individual needs.	Not verified	Yes
IDG9: Co-teaching	Implement co-teaching to provide more hands-on support to students for their practical work.	Not verified	Yes
IDG11: Hybrid classes	Encourage students to attend theory classes online or face-to-face.	Not verified	Yes
IDG12: Online learning environments	Give students the opportunity to learn more effectively by interacting, collaborating, and taking responsibility for their learning through online	Verified	Yes

Guideline Code	Guideline	Status	Require further action
	learning environments.		

The next section presents the action-planning phase of this study. A possible intervention strategy is provided for each guideline during the action-planning phase. The intervention consisted of a plan of action to verify the suitability of the guidelines, with the aim of extending them to be incorporated into the learning context for HCI students.

7.3 Action planning phase

The findings of the first AR cycle serve as a foundation for establishing interventions to address the current situation. The interventions are planned to improve RP skills of the HCI students using guidelines that were not verified and those that needed further action, as shown in Table 7.1. Code C2 was used to refer to AR cycle 2, and PI for possible intervention was used with abbreviations for each category. Table 7.2 presents the possible interventions for AR Cycle 2. It should be noted that the potential interventions were not tailored to the particular context of the institution where this research was conducted. These were presented to demonstrate the practical application of each guideline.

Table 7.2: Possible interventions for guidelines requiring further action (Cycle 2)

Possible intervention	Reference from Table 6.6 and Table 6.26	Guideline reference from Table 6.5
Setting a specific assignment to bridge the theory-practice gap.		
C2TP_PI1: Demonstrate to students how to incorporate principles into their work by providing examples.	C1TP_PI1	TPG1: HCI Principles and goals
C2TP_PI2: Design the practical task to prompt students to use the theoretical and design	C1TP_PI2	

Possible intervention	Reference from Table 6.6 and Table 6.26	Guideline reference from Table 6.5
principles they have learned.		TPG2: User's social context
C2TP_PI3: In the assignment, ask students to identify the principles they have used for their design.	C1TP_PI3	
C2TP_PI4: Request the students to indicate the importance and benefits of incorporating the users of the system in their design.	C1TP_PI4	
C2TP_PI5: In the assignment, ask questions to help students think like users and understand user behaviour.	C1TP_PI5	
C2TP_PI6: Ensure that the students understand the user environment.	EC1P9	
C2TP_PI7: Ask students to identify the intended users and test the system with them.	C1TP_PI6	TPG3: External factors
C2TP_PI8: Ask students to consider cultural, economic, political, and social circumstances that can influence users in their practice.	C1TP_PI7	
C2TP_PI9: Ask students how they applied theory to practical aspects of the assignment.	C1TP_PI8	
C2TP_PI10: Ask students to link theoretical content with practice by having them identify the theoretical content needed to complete practical work and incorporate reflection into their learning.	C1TP_PI9	TPG4: Linking theory with practice
C2TP_PI11: Engage students during the lecture and get feedback using online tools.	C1TP_PI10	
C2TP_PI12: Use the feedback to refine the next interactive lecture.	C1TP_PI11	
C2TP_PI13: Provide students with a case study to apply what they have learned.	C1TP_PI12	TPG5: Interactive lecture with a case study
C2TP_PI14: Have students create user profiles using different types of users and explain how	C1TP_PI13	
		TPG6: User's role

Possible intervention	Reference from Table 6.6 and Table 6.26	Guideline reference from Table 6.5
they intend to meet their needs.		
C2TP_P15: Ask students to brainstorm ideas by using different techniques to create a prototype.	C1TP_P14	TPG7: Prototyping
C2TP_P16: Request students to develop a prototype that represents the actual system.	C1TP_P15	
C2TP_P17: Ask students to allow users to interact with and test the feasibility of the prototype they have developed.	C1TP_P16	
C2TP_P18: Ensure that students use prototypes to gain feedback from users early in the design process.	C1TP_P17	
C2TP_P19: Ask students to refine and iterate until their prototype is final and ready for submission.	C1TP_P18	
C2TP_P20: Recommend that the students should plan their designs first, to serve as a guide throughout the process.	EC1P18	
C2TP_P21: Ask students to get user feedback on the usability of their prototypes by testing with the intended users.	C1TP_P19	TPG8: User testing
C2TP_P22: Assign a reflective sheet or questionnaire to students including questions about the difficulties they experienced while completing the assignment, how they solved those difficulties, and how they would improve their work if they had additional time.	C1TP_P20	TPG9: Document experiences
C2TP_P23: Use a reflective sheet or questionnaire to ask students to draw conclusions from their experiences and evaluate their decisions to reflect on the choices they have made.	C1TP_P21	
C2TP_P24: Ask students to identify areas that	EC1P10	TPG10: Identifying

Possible intervention	Reference from Table 6.6 and Table 6.26	Guideline reference from Table 6.5
are still confusing to them.		additional confusing areas
Guiding reflection by and among students.		
C2RS_PI1: Use a reflective sheet or questionnaire to ask students to identify areas for improvement after providing detailed feedback on their assessed work.	C1RS_PI1	RSG1: Reflective guidelines
C2RS_PI2: Use a reflective sheet or questionnaire to get students be involved in a process of self-inquiry to make connections about what they have learned in theory to practice.	C1RS_PI2	
C2RS_PI3: After reflecting, ask the students to formulate and write a plan on how they are going to apply what they have learned.	C1RS_PI3	
C2RS_PI4: Establish realistic learning goals with your students and ask them to reflect on their progress on a regular base.	C1RS_PI4	
C2RS_PI5: Give students a reflective sheet to incorporate reflection into their learning cycle to assess their prior knowledge and identify knowledge gaps.	C1RS_PI5	RSG2: Prior knowledge
C2RS_PI6: Ask students to examine how the new information fits in with what they already know.	C1RS_PI6	
C2RS_PI7: Create a scenario where students can practice making decisions.	C1RS_PI7	RSG3: Critical skills
C2RS_PI8: Give an assignment that will require students to identify a problem and propose a solution.	C1RS_PI8	
C2RS_PI9: Organise group discussions for students to demonstrate their ability to construct knowledge.	C1RS_PI9	
C2RS_PI10: Encourage students to keep journals	C1RS_PI10	RSG4: Reflective

Possible intervention	Reference from Table 6.6 and Table 6.26	Guideline reference from Table 6.5
or portfolios in which they can reflect on their challenges and learning experiences for personal development.		Journal
C2RS_PI11: Provide students with guided reflection questions on a reflective sheet.	C1RS_PI11	RSG5: Reflective skills
C2RS_PI12: Ask students to observe their thoughts to improve their work.	C1RS_PI12	
C2RS_PI13: Remind students that reflection is an ongoing process.	C1RS_PI13	
C2RS_PI14: Ask students to brainstorm possible solutions to their problems.	C1RS_PI14	RSG6: Problem-solving skills
C2RS_PI15: Having generated many possible solutions, ask students to evaluate the advantages and disadvantages of each.	C1RS_PI15	
C2RS_PI16: Ask students how they are going to apply what they learned in real-life situations.	C1RS_PI16	RSG7: Reflecting on learning
C2RS_PI17: Ask students to create a strategy for how they will adjust their learning based on their understanding and challenges.	C1RS_PI17	
C2RS_PI18: Ask the students to reflect on their first impressions of the assignment and share them with the instructor.	C1RS_PI18	RSG8: Description of the event
General advice to students to improve performance.		
C2IP_PI1: During the lesson, ask students to identify areas they do not understand and ask questions about them.	C1IP_PI1	IPG1: Question-answer session
C2IP_PI2: Set up a separate time for students to consult the Lecturer outside normal class time.	C1IP_PI2	
C2IP_PI3: Ask students to address practical challenges they observe in the community they live in by applying what they have learned in the	C1IP_PI3	IPG2: Students bridging the theory-practice gap

Possible intervention	Reference from Table 6.6 and Table 6.26	Guideline reference from Table 6.5
HCI module.		
C2IP_PI4: Ask students to examine theoretical content they have learned previously so they can apply it to their practical assignments.	C1IP_PI4	
C2IP_PI5: Expect the students to have a barrier against first-time activities.	EC1PI4	
C2IP_PI6: Request students to utilise the schedule in the study guide as a model for managing their time efficiently.	C1IP_PI5	IPG3: Time management
C2IP_PI7: Provide a timeline of when tasks should be completed and set time frames.	C1IP_PI6	
C2IP_PI8: Instruct students on how to identify objectives and divide the task into smaller, more achievable sections.	C1IP_PI7	
C2IP_PI9: Ask students to structure how they are planning to complete the tasks.	C1IP_PI8	
C2IP_PI10: Emphasise the importance of starting the task on time to minimise distractions and procrastination.	EC1PI5	
C2IP_PI11: Ask students to familiarise themselves with the question by reading it several times before attempting to answer it.	C1IP_PI9	
C2IP_PI12: Develop the students' research skills by giving them work that will require researched information.	C1IP_PI10	IPG4: Research and understand the question
C2IP_PI13: Ask students to use reputable sources when conducting research on the Internet.	C1IP_PI11	
C2IP_PI14: Ensure that the students understand what is meant by the terminology in terms of the artefact.	EC1PI1	
C2IP_PI15: Provide the students with general	EC1PI2	

Possible intervention	Reference from Table 6.6 and Table 6.26	Guideline reference from Table 6.5
advice on how to start a project.		
For each question, ask the students to read the instructions several times to ensure they understand the requirements.	EC1PI3	
C2IP_PI16: Encourage students to review the material while the lesson is still fresh in their minds.	C1IP_PI14	IPG7: Studying after lecture
C2IP_PI17: Encourage students to take notes while reading.	EC1PI7	
C2IP_PI18: Request that students acquire accurate responses after being given their graded assignments.	C1IP_PI16	IPG9: Acquiring correct answers
Assessment strategy to promote reflection.		
C2AS_PI1: Provide students with a rubric along with the assignment to assist them with what is expected and how their work will be assessed.	C1AS_PI3	ASG2: Evaluation standards
C2AS_PI2: Use a rubric for evaluation to demonstrate achievement requirements for the students.	C1AS_PI4	
C2AS_PI3: Give students feedback on their progress and encourage them to reflect on their work.	C1AS_PI5	ASG3: Detailed feedback
C2AS_PI4: Use formative assessments (quizzes, tests, etc.) to provide feedback on learning.	C1AS_PI6	
C2AS_PI5: Encourage students to incorporate reflection into their academic activities by regularly reflecting on their work.	C1AS_PI7	ASG4: Reflective practice strategy
C2AS_PI6: Provide students with a reflective sheet after class for students to provide feedback for the lesson completed as part of their assignment.	EC1PI12	ASG5: Post-lesson reflection

Possible intervention	Reference from Table 6.6 and Table 6.26	Guideline reference from Table 6.5
Overall instructional design orientation.		
C2ID_PI1: Provide a description of the persona's function and context.	C1ID_PI5	IDG4: Persona
C2ID_PI2: Create a narrative that depicts how the persona interacts with the product.	C1ID_PI6	
C2ID_PI3: Construct a dialogue to assist students in understanding and relating to the persona.	C1ID_PI7	
C2ID_PI4: Create cross-disciplinary learning settings for students to broaden their knowledge base and deepen their understanding of the application of design principles to various fields.	C1ID_PI8	IDG5: Pedagogical concept
C2ID_PI5: Provide practical skills for students to apply theoretical concepts to real-life situations through practical activities.	C1ID_PI9	IDG6: Theory-practice gap
C2ID_PI6: Prepare students for assignments by asking them to identify the main ideas in theoretical content and to think critically about what they are reading.	EC1PI11	
C2ID_PI7: Give students a new assignment to perform as an assignment based on the work that they were taught recently.	C1ID_PI10	
C2ID_PI8: Adapt your teaching approach to suit the needs of diverse learners and maximize their potential.	C1ID_PI14	IDG8: Maximise students' potential learning
C2ID_PI9: Implement co-teaching to ensure that all students receive the necessary support and individual attention.	C1ID_PI15	IDG9: Co-teaching
C2ID_PI10: Maintain a consistent understanding of the material and the strategies being taught.	C1ID_PI16	
C2ID_PI11: Assign responsibilities and workloads.	C1ID_PI17	
C2ID_PI12: Assess students together.	C1ID_PI18	

Possible intervention	Reference from Table 6.6 and Table 6.26	Guideline reference from Table 6.5
C2ID_PI13: Offer students the option to learn in an online or in-person setting to accommodate their learning style.	C1ID_PI22	IDG11: Hybrid classes
C2ID_PI14: Incorporate a learning management system (LMS) for online teaching and learning.	C1ID_PI23	IDG12: Online environments
C2ID_PI15: Provide students with access to resources such as videos, tutorials, and presentations.	C1ID_PI24	
C2ID_PI16: Encourage collaboration among students by giving them group work that counts towards their final mark.	C1ID_PI25	
C2ID_PI17: Record lectures for students to access them when needed.	C1ID_PI26	

The next section elaborates on the process of implementing the plans, which involved how actions were taken.

7.4 Action-taking phase

This study aims to formulate guidelines for the development of HCI students as reflective practitioners. The proposed interventions were conducted as specified in the preceding section on action planning. The action-taking phase began at the beginning of the semester with the lecturer introducing the module syllabus, schedule, and assessment criteria. The curriculum content, including the study guide, was made available to students on eThuto, the university's learning management system (LMS). Theoretical lessons were provided before student-led practical sessions began. The theory classes continued to be delivered online because of the lockdown imposed by the COVID-19 situation. All lessons were recorded and made available to students using eThuto. During the theory class, a few students actively participated in the classroom activities.

The lecturer introduced the topic and asked the students about their experiences with it during the first official lecture of the semester. The session was held online, and none of the students who were present at the start of the lecture responded to any of the questions posed. It was easier for the students to not participate because their cameras and audio were turned off when they joined the class. According to Efriana (2021), during online sessions, students record their attendance but are inactive afterwards, whereas others join the class but leave the session active and go do something else. Therefore, the situation was not surprising, and the lecturer continued with no student participation, which made the class not interactive. The lecturer was the only one who addressed the class, and students did not participate at all, even when they were later asked a question. At the end of the lecture, one student who arrived late indicated that he was dissatisfied with how the class was conducted on that particular day. The lecturer once again agreed that active participation was a good idea for the second semester, just as in the first semester. The lecturer and students came to an understanding that the class would be repeated and that students would actively participate during the class going forward. Subsequent classes saw a large number of participating students.

The participation of students during classes was important, as it would indicate any misconceptions regarding the topic at hand. Literature shows that active learning bridges the gap between theory and practice (Huda *et al.*, 2016). Another advantage is that it enhances students' learning experiences (Zhuang & Xiao, 2018), promotes critical thinking (Huda *et al.*, 2016), and assists them in developing problem-solving skills (Zayapragassarazan & Kumar, 2012).

The possible interventions listed in the previous section were used as a guide to develop actions to be taken in the second AR cycle. The interventions were developed from possible interventions, sensitive to the context and restrictions in the specific context of this research project at the chosen university in South Africa, Central University of Technology, Free State (CUT, FS). There were two activities that took place during the action-taking phase: intervention talk and an assignment requiring students to design a website, accompanied by a reflective sheet. Based on

the findings from the preceding cycle (Chapter 6), discussions on reflective practice were integrated into the theoretical lectures, and the summary was repeated in class by pointing out the intervention talk plan presented in the next section.

7.4.1 Intervention talk

The findings from the previous AR cycle served as the foundation for establishing interventions to address the current situation. The data from Chapters 3 and 6 were revisited to structure the intervention talk. Table 7.3: Intervention talk (Cycle 2) presents the mapping of the intervention talk with possible interventions from Table 7.2. The actions to be taken were developed in response to the findings to improve students' learning and to develop students as reflective practitioners. The findings were presented to the students as part of an intervention talk during one of the theoretical classes. Code C2_ITV was used to refer to the cycle 2 intervention talk plan.

Table 7.3: Intervention talk (Cycle 2)

Intervention talk plan	Mapped intervention from Table 7.2
C2_ITV1: Reading the question before trying a response to understand what is expected.	C2IP_PI11
C2_ITV2: Asking the lecturer questions related to the work in order to understand.	C2IP_PI12 and C2IP_PI13
C2_ITV3: Researching to gain knowledge.	C2IP_PI12
C2_ITV4: Learning theory first to understand the practical work.	C2TP_PI9
C2_ITV5: Managing time effectively during assessments.	C2IP_PI6
C2_ITV6: Following the instructions carefully during the assessments.	C2IP_PI11
C2_ITV7: Starting the task on time.	C2IP_PI10
C2_ITV8: Revising the work that was taught in class.	C2IP_PI17

Intervention talk plan	Mapped intervention from Table 7.2
C2_ITV9: Taking notes for self-study.	C2IP_PI17
C2_ITV10: Watching lecture recordings.	C2ID_PI15

The intervention entailed a strategy to assess the appropriateness of the guidelines with the objective of integrating them into the learning context for HCI students.

7.4.2 Assignment and reflective sheet

The students were given an assignment along with a reflective sheet. Further details regarding the reflective sheet are presented in Section 7.5.2.

This assignment was the final project to be completed after a discussion. According to Umutlu and Kim (2020), reflection can occur during action. Thus, the reflection-in-action method can assist students in observing themselves while completing assignments and writing about their reflections.

The purpose of the project was founded on the premise that a qualifying student at this level should be competent in designing, developing, and implementing a website or Android interface. The website/application was expected to follow the principles and guidelines learned in the HCI module. One of the outcomes of the module was that the qualifying learner should be able to design and develop a prototype of a website using the Pencil Project or comparable software. The students were given detailed application guidelines to guide them on each section of their website design assignment.

As part of the assignment, students had to design a website to promote one of the specified businesses or any interesting idea of their own that they would like to develop. The students were given a rubric to assist them in understanding how their work would be assessed and to guide them on what they were required to do. The assignment was posted and submitted to a blackboard facility called eThuto, which is

a learning management system (LMS) used at the University of Technology for online teaching and learning.

The actual intervention presented in Table 6.6 in the previous cycle (Chapter 6) was used as a guide and is presented in Table 7.4. Code C2 for AR Cycle 2 and AI for actual intervention were combined and used.

Table 7.4: Actual intervention (Cycle 2)

Actual intervention	Reference from Table 7.2
Setting a specific assignment to bridge the theory-practice gap.	
C2TP_AI1: Students were involved in a task that allowed them to do self-inquiry by making connections about what they had learned in theory to apply in practice.	C2RS_PI2
C2TP_AI2: Students were asked to indicate how they applied what they had learned.	C2TP_PI8
C2TP_AI3: Students were made aware of the different social conditions of the users to consider.	C2TP_PI6
C2TP_AI4: HCI principles were taught, and examples were provided to the students on how to incorporate them into the practical work.	C2TP_PI1
C2TP_AI5: Students were required to identify the HCI theoretical content they used in their assignment.	C2TP_PI2, C2TP_PI3
C2TP_AI6: Students were requested to brainstorm and sketch out their ideas.	C2TP_PI14
C2TP_AI7: The assignment required students to create a mock-up or prototype of a website.	C1TP_PI15
C2TP_AI8: Students were advised to refine and iterate until the prototype was final and ready for submission.	C2TP_PI18
C2TP_AI8: A case study was provided on designing a website to promote one of the businesses specified or any interesting idea of their own that they would like to develop.	C1TP_PI2
C2TP_AI9: In the reflective sheet, students were asked to identify the theoretical work that related to the assignment they were completing.	C1RS_PI11
Guiding reflection by and among students.	

Actual intervention	Reference from Table 7.2
C2RS_AI1: Students were given a reflective sheet to reflect on their learning to assess their prior knowledge.	C2RS_PI2
C2RS_AI2: Students were asked to indicate how they applied what they had learned.	C2RS_PI3
General advice to students to improve performance.	
C2IP_AI1: The lecturer allowed students who were unable to come to campus to contact her via WhatsApp and email.	C1IP_PI2
C2IP_AI2: The lecturer was available for face-to-face consultations on days when the students had practical classes on campus (Tuesdays, Wednesdays, and Thursdays).	C1IP_PI2
C2IP_AI3: Students were reminded to follow the guidelines stated in the study guide for the assessments. CUT (2021:8) manual states <i>“Read the question carefully; make sure you know what is being asked”</i> .	C2IP_PI11
C2IP_AI4: Students were made aware to take note of the specifics of what they were being asked.	C2IP_PI11
C2IP_AI5: Students were requested to use reputable sources when doing research.	C2IP_PI13
C2IP_AI6: Students were requested to follow the schedule provided in the study guide.	C2IP_PI5
C2IP_AI7: Students were advised to start the task on time to be able to go through the theory.	C2IP_PI10
C2IP_AI8: Students were asked to draw up the plan on how they were planning to complete the assignment.	C2IP_PI9
C2IP_AI9: Activities that encourage students to conduct research about the work that they were doing were incorporated into the module in the form of an assignment.	C2IP_PI12
C2IP_AI10: The lecturer observed the completion rate.	C2IP_PI9
Assessment strategy to promote reflection.	
C2AS_AI1: Students were provided with a rubric to guide them on how they were going to be assessed.	C2AS_PI1; C2AS_PI2

Actual intervention	Reference from Table 7.2
C2AS_AI2: Formative assessments in the form of tests were used to provide feedback on learning.	C2AS_PI4
C2AS_AI3: Detailed feedback was provided to the students to assist them in areas that needed improvement.	C2AS_PI3
C2AS_AI4: Students were requested to complete the reflective sheets after receiving feedback on their work.	C2AS_PI6
Overall instructional design orientation.	
C2ID_AI1: Lessons were related to real-life experiences that the students were able to relate to.	C2ID_PI5
C2ID_AI2: Lectures were recorded to allow students to access the session as needed.	C2ID_PI15
C2ID_AI3: The students who were unable to attend due to a variety of circumstances were able to access the recorded session at any time.	C2ID_PI14; and C2ID_PI15
C2ID_AI4: eThuto was used for students to access module content such as class presentations, tests, assignments, and classes.	C2ID_PI5
C2ID_AI5: The assignment included theoretical key concepts based on the work that they had been taught recently.	C2ID_PI7

The next section presents an evaluation of the participants' data.

7.5 Evaluation phase

The purpose of the evaluation phase was to investigate the suitability of these guidelines. The data obtained from the participants were used to test the guidelines. The evaluation report included biographical information on the participants, as presented in Section 7.5.1. Section 7.5.2 presents the data collection for this cycle. The data analysis is presented in Section 7.5.3. The students' opinions and the lecturer's perspectives were discussed and analysed, and conclusions were drawn.

7.5.1 Participants biographical details

During this cycle, participants were registered in the second semester of the HCI module. The first-semester module was a prerequisite for the second-semester module. All the students who completed the assignment were invited to participate in the study. During the second semester, the class had 68 students taking the module in their second year of study, 30 students enrolled in the extended program, and eight students who were registered for the phased-out National Diploma in Information Technology and took the module in their third year of study. Of 106 students registered in the module, 43 participated. Codes were used to maintain the participants' anonymity and privacy, as indicated in the ethics section in Chapter 2 (Section 2.7). The code *ptp* was used to refer to the participants.

Table 7.5 shows the demographics of the students who participated in this cycle, including their age, gender, and whether they were repeating the module. The data indicated that five participants were repeating the module and 38 participants registered for the module for the first time. Codes were used to maintain the participants' anonymity and privacy, as indicated in the ethics section in Chapter 2 (Section 2.7). The code *ptp* was used to refer to the participants.

Table 7.5: Participants' profiles (Cycle 2)

Age	Gender	Participants	Repeaters	Total
19 - 21	F	<i>ptp06, ptp07, ptp09, ptp14, ptp18, ptp28, ptp30, ptp31</i>		8
	M	<i>ptp02, ptp03, ptp04, ptp11, ptp24</i>	<i>ptp42</i>	6
22 - 25	F	<i>ptp10, ptp17, ptp20, ptp23, ptp25, ptp27, ptp33, ptp34, ptp35</i>	<i>ptp15</i>	10
	M	<i>ptp01, ptp05, ptp19, ptp21, ptp22, ptp26, ptp29, ptp32, ptp37, ptp40, ptp41, ptp43</i>	<i>ptp38</i>	13
26 - 29	F	<i>ptp08, ptp36</i>	<i>ptp39</i>	3
	M	<i>ptp12, ptp13</i>	<i>ptp16</i>	3
Total				43

The next section discusses how data were collected.

7.5.2 Data collection

As described in the previous chapter (Section 6.5.2), data collection was performed according to a set procedure. An interpretive reflective sheet was designed to gain a better understanding of students' perceptions of how they related theoretical class activities to practical ones. This was done to improve RP skills by asking a few broad questions to determine whether the theory content helped them complete their practical projects.

The participating students were required to complete a reflective sheet while completing their assignments. Therefore, the reflection-in-action method was used in this chapter. According to Schön (1987), a learning-by-doing approach should be emphasised in professional education to promote students' capacity to reflect in action.

The aim of the reflective sheet was explained in one theoretical class. A notice was posted on eThuto requesting students to participate. A link was provided to access the reflective sheet. QuestionPro online survey software was used to collect the data. The reflective sheet entailed open-ended questions that did not restrict students regarding the length of their answers. A reflective sheet was made available on 13 October 2021. The last student to participate completed a reflective sheet on 24 October 2021.

The next section describes the data analysis approach used to analyse the data.

7.5.3 Data analysis

7.5.3.1 Preparing the data

The data collected were already in an electronic file in text format and were ready to be entered into Atlas.ti software.

7.5.3.2 Defining the unit of analysis

Each response to the questions served as a unit of analysis for describing the data. The respondents were asked the same questions using reflective sheets. Participants' responses, phrases, and words were used to define the unit of analysis. The fundamental principle of the hermeneutic cycle was applied to gain a better perspective of the responses offered, as specified in Table 2.4. The meaning of the individual parts and their relationships were then utilised to understand the respondents' responses. Each response was analysed extensively, and the data were thoroughly explained.

7.5.3.3 Developing categories and coding consistency

The codes were used to provide a brief description of the data and categories were created to provide the meaning of the codes. Categories were formed by grouping codes that contribute to the same context or meaning. A sample of the category on solving challenging activities produced during the analysis is shown in Figure 7.1.

☐  Researching solution		7	[Solving challenging activities]
☐  Manage time effectively		3	[Solving challenging activities]
☐  Use alternative software		2	[Solving challenging activities]

Figure 7.1:The category on solving challenging activities extracted from Atlas.ti

7.5.3.4 Testing the coding scheme on a sample

This step entailed coding a unit of analysis such as a piece of text. A response from one of the questions was used as a sample for the question as a unit of analysis in Code extract 7.1.

Code extract 7.1: *What is the most challenging part of the assignment? How are you going to solve it?*

Response	Codes
<i>Ptp09: Linking pages is the most challenging part and adding background photos, I am going to watch different tutorials so</i>	Linking pages challenge Watch tutorial videos

<i>that I can overcome that challenge.</i>	
<i>Ptp13: How to put a logo on my home page. I did research.</i>	Inserting image challenge Researched solution
<i>Ptp22: Was inserting the images. Funny enough it took me a day and a half to figure out how, but I managed to install a plug-in.</i>	Inserting image challenge Installed software plug-in

As there were two expected responses, the two codes were derived from the response. The first code was linked to the difficulty encountered when completing the task. The second code was associated with the solution used to address this problem. The remaining text was coded in the next section.

7.5.3.5 Coding all text

The codes were developed using data provided by the participants. The entire text was coded by assigning a code to each text. Each data item was examined to determine the code that best characterised it. Patterns observed in the codes were used to produce categories. The complete transcript was coded, as shown in Figure 7.2, and the groups were displayed alphabetically by category.

Name	Grounded	Groups
○ ◇ Experience design theory		2 [Applied theory]
○ ◇ Visual interface design theory		2 [Applied theory]
○ ◇ Typography theory		10 [Applied theory]
○ ◇ Envisionment theory		2 [Applied theory]
○ ◇ Theory not specified		11 [Applied theory]
○ ◇ Colour application theory		14 [Applied theory]
○ ◇ Design guidelines		14 [Applied theory]
○ ◇ Choose appropriate colours		1 [Assignment completion plan]
○ ◇ Follow instructions		5 [Assignment completion plan]
○ ◇ Test the project		1 [Assignment completion plan]
○ ◇ Create conducive environment		1 [Assignment completion plan]
○ ◇ Seek help		1 [Assignment completion plan]
○ ◇ Start with simple questions		1 [Assignment completion plan]
○ ◇ Consult the Lecturer		2 [Assignment completion plan]
○ ◇ Plan before designing		19 [Assignment completion plan]
○ ◇ Avoid procrastination		2 [Assignment completion plan]
○ ◇ Develop the website		1 [Assignment completion plan]
○ ◇ Use prescribed software		8 [Assignment completion plan]
○ ◇ No plan specified		1 [Assignment completion plan]
○ ◇ Create notes		1 [Assignment completion plan]
○ ◇ Download prescribed software		1 [Assignment completion plan]
○ ◇ Conduct research		11 [Assignment completion plan]
○ ◇ Understand instructions		6 [Assignment completion plan]
○ ◇ File organization		1 [Assignment completion plan]
○ ◇ Execute plan		6 [Assignment completion plan]
○ ◇ Recall required information		1 [Assignment completion plan]
○ ◇ Read theoretical content		5 [Assignment completion plan] [Knowledge application] [Solving challenging activities]
○ ◇ Watch tutorial videos		19 [Assignment completion plan] [Solving challenging activities]
○ ◇ Limited time		1 [Assignment completion timeframe]
○ ◇ Less than two weeks		5 [Assignment completion timeframe]
○ ◇ Few hours		4 [Assignment completion timeframe]
○ ◇ Three weeks		2 [Assignment completion timeframe]
○ ◇ Less than a week		5 [Assignment completion timeframe]
○ ◇ Timeframe not specified		6 [Assignment completion timeframe]
○ ◇ A month		2 [Assignment completion timeframe]
○ ◇ One week		6 [Assignment completion timeframe]
○ ◇ Two weeks		12 [Assignment completion timeframe]
○ ◇ Five weeks		1 [Assignment completion timeframe]
○ ◇ Choosing relevant content		1 [Challenging activities]
○ ◇ Create interactive forms		2 [Challenging activities]
○ ◇ Applying prescribed software		4 [Challenging activities]
○ ◇ Linking pages challenge		7 [Challenging activities]
○ ◇ Design challenge		9 [Challenging activities]
○ ◇ Colour application challenge		2 [Challenging activities]
○ ◇ Inserting images challenge		14 [Challenging activities]
○ ◇ No challenge specified		5 [Challenging activities]

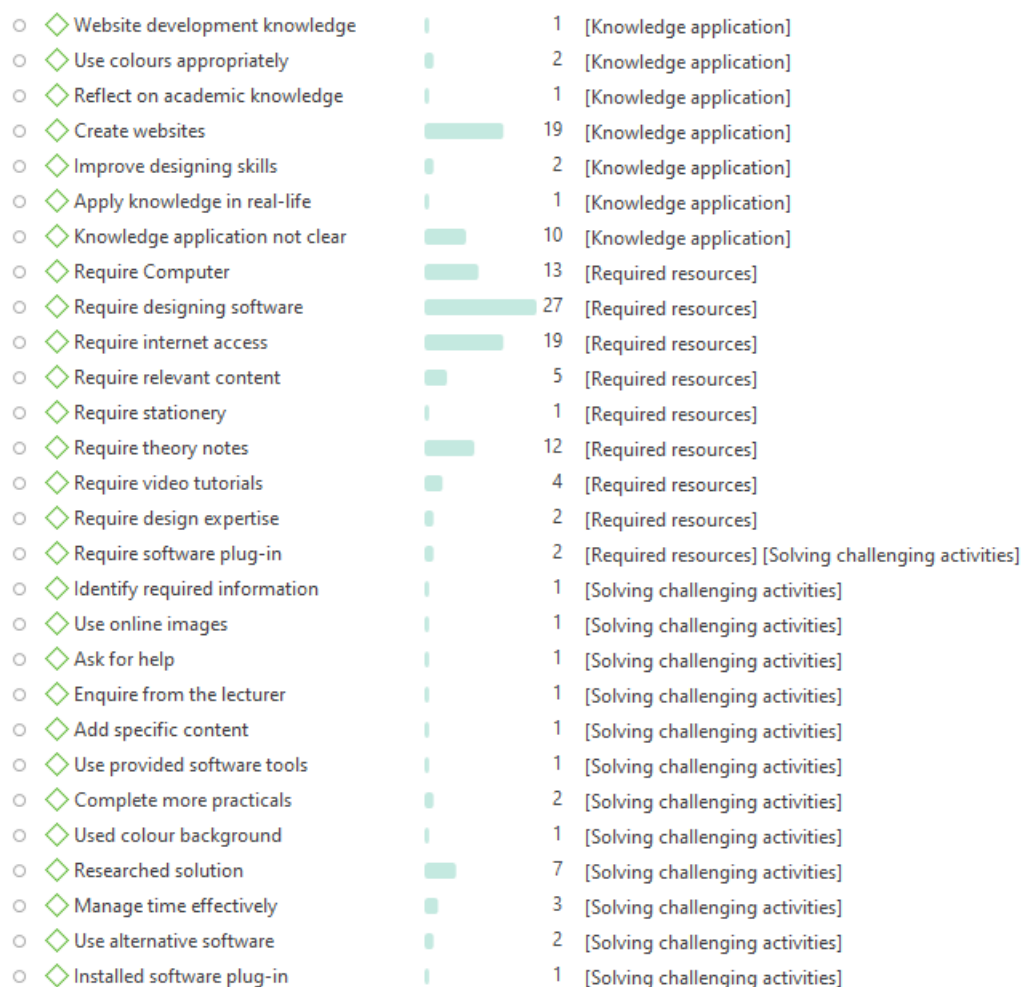


Figure 7.2: Codes extracted from Atlas.ti

7.5.3.6 Assessing consistency

The coding was thoroughly checked for accuracy twice. This technique was used for each answer to determine whether the code was appropriate for the data. When updates were required, they were performed immediately to ensure that no code was missed during the process. There was inconsistency with some of the codes, e.g., “watched tutorials” and “watch videos.” This inconsistency was created by codes drawn from different documents (different questions) to indicate the difference, as indicated in Code Extract 7.2.

Code extract 7.2: What is the most challenging part of the assignment? How are you going to solve it?

Response	Code
<i>Stu08: I watched the videos from eThuto</i>	Watched tutorials

Code extract 7.3: What steps are you going to take to complete the assignment?

Response	Code
<i>Stu06: I'm going to follow what is done in the videos provided and create my own mock-up website using a pencil project</i>	Watch videos

The researcher learned that when students reflect, some of the codes may overlap. The codes were then merged to form one code, “watch tutorial videos.” The researcher examined all the codes in the document to check for duplicates, and those found were rectified.

Following the assessment of the code consistency, conclusions were drawn from the data collected as discussed in the next section.

7.5.4 Drawing conclusions from the data

This phase involved making sense of all identified categories. The researcher identified the categories reflected in the data. Each category was examined to obtain meaning from the data. Seven categories were created from the data obtained in order to aid in the purpose of the research: *assignment completion plan*, *assignment completion timeframe*, *applied theoretical content*, *challenging activities*, *solving challenging activities*, *knowledge application*, and *required resources*. The following subsections describe these categories in detail.

7.5.4.1 Assignment completion plan category

In this category, to improve students’ RP skills, they were asked what steps they were going to take to complete the assignment. The purpose of the question was to

determine whether students had some kind of plan before they carried out their work. On the other hand, for those who carried out the work without planning, the question was aimed at assisting them in reflecting on the process of completing the assignment and stating it as a plan. The question was related to Guideline Category 5: *Reflective guidelines* for students to reflect on their plans. Different responses were provided and coded accordingly, as shown in Table 7.6.

Table 7.6: Summary of assignment completion plan category codes

Code No.	Code	Frequency
1.	Plan before designing	19
2.	Watch tutorial videos	19
3.	Conduct research	11
4.	Use prescribed software	8
5.	Execute plan	6
6.	Understand instructions	6
7.	Follow instructions	5
8.	Read theory	5
9.	Consult the Lecturer	2
10.	Avoid procrastination	2

The “***assignment completion plan category***” for HCI students can be summarised as follows:

- The participants understood the need for planning before starting the assignment. Drafting a plan first was to assist with the steps to be taken when carrying out actual work. The participants also found that they needed to identify the information needed to complete the assignment efficiently and effectively with little effort. “*Do rough work planning, collecting relevant content and implement according to the plan*” (ptp02); “*Firstly, I draft my plan, which includes more of information I'd need, then go through my project following my plan*” (ptp40).

- Video tutorials were identified as mechanisms that assist in completing assignments. *"I'm going to follow what is done in the videos provided and create my own mock-up website using pencil project"* (ptp06).
- Participants recognised the need to read the instructions thoroughly to ensure that they understood what they were required to do. *"Carefully read the instructions and make sure that I understand what is expected from me"* (ptp08).
- In order to avoid working under pressure, the participants realised that starting the assignment on time and drafting the schedule would assist with managing time. *"I am going to START. Starting is the first step toward avoiding procrastination. Time management: I will draft in a schedule"* (ptp22).
- Reading through the assignment information provided with the assignment instructions was identified by the participants as something that assisted in obtaining a clear picture of what needed to be done. *"Read over content that's provided for me to understand how to incorporate it into the assignment. Read over instructions in order to grasp what really needs to be done"* (ptp23); *"First I am going to read through the assignment and understand it"* (ptp26).
- In order to complete the assignment effectively, participants perceived the need to search for the required information. *"I'll be doing my own research while using materials from the lecturer to complete the assignment"* (ptp25); *"I am going to first research about the topic which I have chosen. Watch the content videos again to determine what is required. Read through the assignment and plan the website layout. Finally, do the project"* (ptp28).
- Some participants developed a complete step-by-step plan for how they were going to complete the assignment from start to finish. *"1. Planning on a page. 2. Collect data and information that I will need to create a website. 3. Watch videos on the Internet for directions and ideas on how to start a website. 4. Where I do not know what I expected to do, I will ask for a lecture. 5. Create a website. 6. Test it on other devices to ensure that it does not work only on my PC"* (ptp30).
- The participants learned that they needed to start with a plan for the prototype of their work on paper before implementing the assignment using the software. *"I'm first going to plan my mock-up on a piece of paper, then make research on other aspects of my mock-up website before using to Pencil project and begin the final mock-up"* (ptp38).

The lessons learned from this category indicated that planning before starting work was important for the participants. Understanding and following the instructions were also mentioned as part of the plan to complete the assignment. The next section presents the timeframes in which participants had to complete the assignment. This depended on the time when they started. The next section presents *the assignment completion timeframe* category.

7.5.4.2 Assignment completion timeframe category

In this section, participants were asked about the time they had, or the time left to complete the assignment. The aim of the question was for the participants to reflect on the amount of time they had to complete the assignment. The question was asked to improve the participants' RP skills by knowing how much time was left. The question was related to Guideline Category 8: *Time management*. The participants were able to reflect on and specify different timeframes depending on when they started the assignment. Different responses were provided and coded accordingly, as presented in Table 7.7.

Table 7.7: Summary of the codes from the category on assignment completion timeframe

Code No.	Code	Frequency
1.	Two weeks	12
2.	One week	6
3.	Timeframe not specified	6
4.	Less than two weeks	5
5.	Less than a week	5
6.	Few hours	4
7.	A month	2
8.	Three weeks	2
9.	Five weeks	1
10.	Limited time	1

The “**assignment completion timeframe category**” for HCI students can be summarised as follows:

- The participants realised that the level of creativity played a major role in the design. They also believed that creativity had an impact on the time taken to complete assignments. *“A day or two, depending on my level of creativity and speed”*. (ptp02).
- Participants realised the importance of planning time according to the amount of work to be completed *“For every 5% the assignment is worth, I should plan to work 2 hours”* (ptp08).
- The participants were able to estimate whether the time was sufficient to complete the assignment. *“I have about 20 days to complete the assignment from the day of the issue, which is more than enough time for me to complete it successfully”*. (ptp23).
- Several participants started the assignment on the day it was made available on eThuto and had sufficient time to complete it. *“The time frame for completing the assignment is 5 Weeks”* (ptp38).
- Some participants did not specify the timeframe for completing the assignment but were able to estimate when they would complete the assignment. *“By Saturday I think I'll be done”* (ptp41).

The findings revealed that participants did not start the assignment at the same time. Some participants started much earlier, whereas others started later. The next section presents the theoretical content used by the participants to complete the assignment.

7.5.4.3 Applied theoretical content category

In this category, participants were asked to specify the theoretical content they were going to apply to assist them in completing the assignment. The purpose of this question was to establish whether participants were able to identify the theory sections applied to their work. The other purpose was to reflect on the relationship between the theoretical and the practical components of their work. Different

sections of the theory were mentioned and applied to the assignment. Different responses were provided and coded accordingly, as presented in Table 7.8.

Table 7.8: Summary of applied theory category codes

Code No.	Code	Frequency
1.	Design guidelines	14
2.	Colour application theory	14
3.	Theory not specified	11
4.	Typography theory	10
5.	Envisionment theory	2
6.	Visual interface design theory	2
7.	Experience design theory	2

The HCI students' responses to the "***applied theory category***" can be summarised as follows:

- Participants understood the importance of the theory pertaining to how to use colour in their designs. *"The physics of colour, more especially knowing that I'm not good at colour combinations but with that focus on colour, this will help my mock-up to be more appealing and eye-catchy"* (ptp02).
- Participants realised that the theoretical component discussed in class was useful for application in the assignment even if they did not mention a specific section. *"What we did in classes"* (ptp05).
- The participants understood that the HCI content during the theory classes was applicable to the practical work they were doing. *"All theory relates to the assignment for full-on functionality of website"* (ptp21).
- The participants realised the importance and value of the theory. They also knew how they were going to apply it and how it was going to enhance certain aspects of their practical work. *"Everything in the theory is important, especially the colours as well as font sizes on a website since these are crucial as they serve as the basis of everything that will follow. So, I am going to use and apply these"*

theories, and they are already helping me with the look of my website. They make the content look quite professional, having the same font on the same pages, having supplementary colours which are easy to the eye and still look beautiful, and my favourite is monochromatic colours because they enhance everything on my website making it appealing.” (ptp23).

- Some participants were particularly interested in the content they used for different sections of the assignment. *“The guidelines of the layout of pages, the appropriate colours to use from the colour wheel and the navigation of pages” (ptp38).*
- Not all participants appreciated the theoretical content done in the module but preferred to use content that was available online to complete their assignments. *“I prefer using YouTube video tutorials” (ptp40).*

The findings in this section indicate that most participants were aware that design guidelines were available and that they could use them to complete the assignment. The next section presents the challenges encountered by participants when they completed the assignment.

7.5.4.4 Challenging activities category

In this section, participants were asked to identify the most challenging part of the assignment. The aim of the question was for the participants to reflect on the challenges they experienced while they were in the process of completing the work. The question was related to Guideline Category 3: *Reflecting on the process*, which included students documenting the difficulties they experienced. The participants mentioned different sections related to their work as being challenging. Other participants tried to be creative and learned that what they wanted to do to be creative was challenging. Different responses were provided and coded accordingly, as presented in Table 7.9.

Table 7.9: Summary of challenging activities category codes

Code No.	Code	Frequency
1.	Inserting images challenge	14
2.	Design challenge	9
3.	Linking pages challenge	7
4.	No challenge specified	5
5.	Applying prescribed software	4
6.	Colour application challenge	2
7.	Create interactive forms	2
8.	Choosing relevant content	1

The “**challenging activities category**” for HCI students can be summarised as follows:

- Some participants found that it was challenging to find the correct colours to use in the assignment. *“Well for me the most challenging part was combining proper colour that couldn't cost us high contrast or intensity and non-readable so mixing colour to make it make sense was so challenging” (ptp02).*
- Determining the layout and relationship between website pages was challenging for some participants. *“Designing a layout, first identifying my pages and how they related to each other”. (ptp04).*
- Some participants found that including the background of the website on individual pages and connecting the pages were complicated. *“Linking pages is the most challenging part and adding background photos” (ptp09); “The challenging part was inserting a background picture” (ptp12).*
- Developing an interactive website, being creative, and inserting pictures into a website were difficult tasks for some participants. *“Creating an interactive website was my most challenging task in this assignment. As well as adding pictures and icons with links.” (ptp23).*

- Other participants found creating editable forms for websites challenging. *“The most challenging thing is to create forms that will be editable or search button because that software can’t allow us to do so since it is more about wireframe” (ptp30).*
- Using the prescribed software for the first time was challenging for some participants. *“Using the pencil software is quite challenging when you use it for the first time” (ptp43).*

The lesson learned from this section is that the challenges experienced by the participants related to what they were supposed to apply in their design, for example, linking pages. The next section describes how they solved the problems they encountered.

7.5.4.5 Solving challenging activities category

Participants were asked how they would solve the challenging activities mentioned in the previous section. The purpose of this question was to determine what the participants did to solve the problems they faced. This question was related to Guideline Category 3: *Reflecting on the process*, which required students to document how they solved the problems encountered. Participants were required to reflect on what they had done to solve the challenging situations they encountered. The purpose of discussing the activities that the students found challenging during learning was to help students learn new ways of solving problems. Participants mentioned how they managed to solve the problems they encountered. Different responses were provided and coded accordingly, as presented in Table 7.10.

Table 7.10: Summary of the codes in the solving challenging activities category

Code No.	Code	Frequency
1.	Watch tutorial videos	19
2.	Researched solution	7
3.	Read theoretical content	5
4.	Manage time effectively	3
5.	Complete more practical	2

Code No.	Code	Frequency
6.	Use alternative software	2
7.	Require software plug-in	2
8.	Identify required information	1
9.	Use online images	1
10.	Ask for help	1

The **“solving challenging activities category”** for HCI students can be summarised as follows:

- Watching tutorials was regarded as one of the methods to solve the problems encountered in the assignment. *“I will follow up on some tutorials” (ptp06).*
- The tutorials also assisted participants in understanding what they needed to do to solve the challenges experienced. *“I managed to understand after watching the tutorials” (ptp07).*
- Participants also realised that they could use search engines to find ways to solve the challenges experienced. *“I have solved it by using Google” (ptp10); “I’ll try to find all the information that will help me on Google and other resources” (ptp36).*
- Using an alternative solution was another option the participants identified to resolve the issues at hand. *“I had to compromise and make a colour background” (ptp12); “I had to go with the tools given on pencil Project” (ptp15).*
- The participants realised that practising by completing more exercises would improve their practical skills. *“I’m going to do more practical work to improve my weak points” (ptp14).*
- Requesting assistance from the lecturer and conducting Internet research were some of the options identified by the participants to solve the problems they encountered. *“I am not too sure how to go about it, but I will try my best to inquire the lecturer where I need assistance the most as well as research on the Internet for further information” (ptp23).*

- Participants were cognisant of the fact that they could request assistance from people who were more knowledgeable about the problems they faced. *“I will watch videos and ask someone for clarity so that it becomes easier” (ptp27).*

The lesson learned from this section was that the participants were able to come up with solutions to solve the problems encountered. The next section presents how participants applied the knowledge gained from the assignment.

7.5.4.6 Knowledge application category

In this section, the participants were asked to establish what they intended to do with the skills acquired while completing the assignment. They were required to reflect on how they were planning to apply the knowledge or understanding they had gained in this assignment. This question was related to Guideline Category 5: *Reflective guidelines*, which required students to make connections regarding what they have learned theoretically with practice. The aim was to determine whether what they had learned was valuable, and whether it could be applied to other areas. Different responses were provided and coded accordingly, as shown in Table 7.11.

Table 7.11: Summary of knowledge application category codes

Code No.	Code	Frequency
1.	Create websites	19
2.	Knowledge application not clear	10
3.	Read theoretical content	5
4.	Improve designing skills	2
5.	Use colours appropriately	2
6.	Apply knowledge in real-life	1
7.	Reflect on academic knowledge	1
8.	Website development knowledge	1
9.	Understand the problem	1

The **“knowledge application category”** for HCI students can be summarised as follows:

- The participants were aware that the module’s content could be used in real-life situations. *“With the knowledge, I would have gained here, I’m going to use it in a real-life situation with the creation of my websites, that before any actual work, there should be a mock-up which now serves as the vision and navigation of my work” (ptp02).*
- The participants realised that prior knowledge played a significant role in understanding the questions asked during the assessment. *“Making sure I understand what is being asked from me then act on my understanding” (ptp07).*
- Participants found that they learned from creating websites; the more websites they created, the more they learned. *“By creating more websites and getting more knowledge about websites” (ptp10).*
- The participants realised that reading the theory notes continuously could assist them in understanding the content. *“That it is wise to read notes every day” (ptp13).*
- The participants realised that the knowledge gained was important for creating the prototype. This would assist in reviewing the designs before they were implemented. *“For future references, if I am trying to create an app or a website for someone, I can use pencil Project to show them how the app or the website is going to look before working on it so that we agree on the design” (ptp15); “I’ll be planning my website out before creating it” (ptp25).*
- Some participants were uncertain about what to do with the information they were taught during theory classes. *“I am currently unsure” (ptp28).*

The findings in this section indicated that participants would be able to apply the knowledge gained from the assignment to real-life situations. The next section discusses the resources that the participants needed to complete the assignment.

7.5.4.7 Required resources category

Resources were required for the assignment to be successfully completed. In this category, the participants were asked to identify the resources they needed to complete the assignment. The aim of this question was to establish whether

participants were able to reflect on the resources they needed to complete the work. Different resources were identified and mentioned. The responses were coded accordingly as shown in Table 7.12.

Table 7.12: Summary of required resources category codes

Code No.	Code	Frequency
1.	Require designing software	27
2.	Require internet access	19
3.	Require Computer	13
4.	Require theory notes	12
5.	Require relevant content	5
6.	Require video tutorials	4
7.	Require design expertise	2
8.	Require software plug-in	2
9.	Require stationery	1

The **“required resources category”** for HCI students can be summarised as follows:

- The use of videos to learn and revise as well as theory slides to execute practical assignments according to what has been learned in theory classes were mentioned as some of the resources required. *“I am going to need videos and slides” (ptp09).*
- Participants regarded the laptop (computer) as a required resource because, without it, they were unable to complete the assignment. The application for creating a website was also identified as an important resource. *“My laptop, the app to create the website on module notes and the internet” (ptp10).*
- They also identified relevant information and corresponding images on the website as significant resources for its development. *“Information and pictures of the website I will be developing” (ptp14).*

- Simple paper and pencil were identified by the participants as the basic resources required for planning the design before using the software to implement it. *“I need paper and pencil so that I can first plan my prototype on paper before I can move it to the Pencil project” (ptp01).*
- Participants also mentioned Internet connection to research the images to be used on an assignment and an applicable tool to create the banner and logo as one of the resources required to complete the assignment. *“Pencil project, internet for pictures, a tool to make the banner and logo and the content of the module” (ptp28).*

The findings in this section indicate that participants were able to identify the resources they needed to complete the assignment. The next section describes the phase of AR where students were required to ***specify learning***.

7.6 Specify learning phase

Reflecting on the data collected, the researcher examined the intervention results to determine if any progress had been made. In this section, reflections are presented for each category, starting with the plans for completing the assignment, advancing to the challenges experienced, and concluding with the resources needed.

7.6.1 Reflections from the assignment completion plan category

Students were expected to develop quality work that would make them proud of completing their assignments. Their plans were expected to include working on the idea that they wanted to communicate on the websites that they were creating. Their plans depended on the knowledge they possessed when creating the website. Some students, who were uncertain about where to start, were required to watch tutorials as part of the plan before starting the assignment. Understanding the instructions given for the assignment was an important part of knowing what was required to implement the plan. The actions taken by participants and the supported guidelines are listed in Table 7.13.

Table 7.13: Supported guidelines from assignment completion plan data

Data in support	Supported guidelines from Table 6.27
General advice to students to improve performance.	
Consulting the lecturer to ask about parts of work that the students do not understand.	IPG1: Question-answer session
Reading theory first to complete the assignment.	IPG2: Students bridging the theory-practice gap
Avoiding procrastination.	IPG3: Time management
Using the prescribed software for the assignment.	IPG4: Research and understand the question
Understanding instructions to complete the assignment.	IPG4: Research and understand the question
Following the instructions given to complete the assignment.	IPG4: Research and understand the question
Conducting research first to find information to use in the assignment.	IPG4: Research and understand the question
Setting a specific assignment to bridge the theory-practice gap.	
Planning before designing was a step to take to complete the assignment.	TPG7: Prototyping
Executing the planned actions to complete the assignment.	TPG7: Prototyping
Overall instructional design orientation.	
Watching tutorial videos that are made available on eThuto.	IDG12: Online learning environments

The participants indicated that they would begin by developing a plan for what they wanted to undertake. Next, the project was implemented in accordance with the plan created by collecting the required information. The students' strategy involved gathering the necessary information before beginning the assignment. This was a significant step in the project. When this information was in place, it contributed significantly to the project's seamless execution. It enabled them to know where to

start a project and to avoid procrastination. Another benefit was advance knowledge of what resources would be employed in the final project and having them ready at the onset of the assignment.

Drafting the schedule as part of the plan was mentioned by ptp22. It is critical to clearly define what can be achieved within a project's timeframe. Students should be realistic about their expectations that a project may take longer than expected. The experience of working on similar tasks can significantly assist in completing assignments faster. For students who are experiencing work for the first time, this might take longer than expected. Such students need to familiarise themselves with the type of work they need to complete for their assignment first or watch tutorial videos.

In addition to the material received from the lecturer, Ptp25 indicated that she was going to conduct her own research. Researching the information related to what you are doing is essential so that you have sufficient knowledge to apply to the assignment. Having sufficient knowledge was important for the students to submit an assignment that was of good quality and met the requirements. It was possible for the students to also research information or the instructions they needed to follow to complete their assignments on time. This would also assist with any additional requirements that the students might want to include, with a focus on completing the assignment.

The next section presents reflections from the ***assignment completion timeframe*** category.

7.6.2 Reflections from assignment completion timeframe category

Although procrastination was mentioned by the participants, it is not unique to HCI students. Literature has shown that procrastination is a widespread issue that can lead to students failing the module (Edwards *et al.*, 2015). According to the data collected, not all students began working on the assignment on the day it was made available. Some students started immediately, whereas others began closer to the submission date. The drawback of starting the assignment close to the deadline may be that there is a possibility that the quality of work may not be good enough. Another drawback is the lack of time to rectify mistakes.

In order to overcome the habit of procrastination, students need to have a system that allows them to prepare ahead and complete tasks on time. Having a time management system in place may relieve the pressure on students and thus enable them to complete their work on time. Some students had a time management system, while others did not. Ptp08 mentioned that she was planning to spend two hours for every 5% of the work. This plan enabled the student to estimate how long it was going to take to finish the assignment. It is critical to be prepared on time to prevent unforeseen distractions that may interfere with what must be done. As a means to avoid disappointment, students can take time to avoid running out of time and submit to poor-quality work.

Ptp23 stated that she had more than enough time to finish the work effectively. Good time management also relieves the pressure when working in a state of agitation. Setting targets based on the timeframe is essential for determining what needs to be achieved while working on the assignment, as well as when it needs to be completed. Therefore, it is important to plan a reasonable time frame. Being realistic about how long it will take to complete the project and what can be completed within the period you have been given will assist in completing the project on time.

In summary, the following guidelines are supported by the data analysis of this category in Table 7.14.

Table 7.14: Supported guideline from data on assignment completion timeframe

Data in support	Supported guidelines from Table 6.27
General advice to students to improve performance.	
For every 5%-mark allocation, plan to work 2 hours.	IPG3: Time management

Not all students specified the timeframe for completing the assignments. Ptp41 only mentioned that he thought he would finish doing the assignment by a certain day of the week. This was another system to manage the time required to complete the assignment. Students should have sufficient time to complete their assignments successfully. In this category, the students used different time management systems that worked for them.

The next section presents reflections on the *applied theoretical content* category.

7.6.3 Reflections from the applied theoretical content category

The theoretical component was important for properly communicating the contents of the assignment as a means of earning the best scores during assessments. In this category, the desired situation was one in which students acquired new ideas as a result of class discussions and reading theoretical content. The emphasis was on developing their thoughts and ideas rather than simply applying what they learned in class. They were allowed to be creative and think for themselves. The guidelines supported by the data analysis of this category are presented in Table 7.15.

Table 7.15: Supported guidelines from applied theoretical content data

Data in support	Supported guidelines from Table 6.27
Setting a specific assignment to bridge the theory-practice gap.	
Participants used colour application theory content.	TPG4: Linking theory with practice
Typography theory content was used for the layout of the text.	TPG4: Linking theory with practice
Participants utilised envisionment theory content in their assignment.	TPG4: Linking theory with practice
Visual interface design theory content was applied in the assignment.	TPG4: Linking theory with practice
Participants made use of experience design theory content.	TPG4: Linking theory with practice
Participants followed the design guidelines to complete the assignment.	TPG1: HCI Principles and goals

Students took responsibility for their learning and performance in applying and relating classroom information to their understanding of HCI module assignments. Ptp05 mentioned that the theoretical component addressed during the classes was appropriate to the assignment as a whole but did not mention a specific topic. This demonstrated that students could apply what they had learned in previous theory

classes to their assignments. Ptp23 also indicated that all theoretical components of the module were very important.

Colour is an important aspect when designing a website mock-up that is visually pleasant. Ptp02 mentioned that he knew that he was not good at colour combinations. Reading the theory that addressed colour enabled him to create an eye-catching website. Web designers and developers use a variety of colours; consequently, the colour component was included as part of the module and addressed before they began working on the assignment. Ptp23 noted that the application of the theory of colour was crucial in the execution of the assignment. She also mentioned that colour served as the foundation for the entire design. Colours have the potential to make designs appear more professional and user-friendly. It was critical for students to understand what colours complement each other best and which ones are compatible with one another before they began integrating any colours to be able to construct a visually appealing website.

Ptp38 specified that “navigation of pages” was crucial for the assignment. The students understood that, when designing a website, navigation was essential for indicating to the users where they were and what alternatives they had when visiting the site. Without navigation, users would not know how to use a website. The students were also taught about different navigational structures. As website designers for their assignments, students were allowed to make assumptions about how their users would locate or access the information that they wanted to engage with by selecting the relevant navigation structure. Reflecting on the comments of the participants, the data indicated that they appreciated the need to apply theory to their practical work.

The next section presents reflections from the ***challenging activities*** category.

7.6.4 Reflections from challenging activities category

In this category, students identified and documented activities that they found challenging in the assignment. This allowed the students to communicate their experiences. This was an opportunity to understand students’ experiences with the challenges encountered while completing the assignment. The guidelines presented in Table 7.16 were supported by data analysis.

Table 7.16: Supported guidelines from challenging activities data

Data in support	Supported guidelines from Table 6.27
General advice to students to improve performance.	
Choosing relevant content for the assignment.	IPG2: Students bridging the theory-practice gap
Inserting the images for the first time was a challenge.	IPG2: Students bridging the theory-practice gap
Designing a website for the assignment was challenging.	IPG2: Students bridging the theory-practice gap
Linking website pages was challenging.	IPG2: Students bridging the theory-practice gap

The data revealed that incorporating creativity into the assignment was very challenging for some students. Ptp02 remarked that it was difficult to combine appropriate colours that were screen-friendly and did not have much contrast. Ptp04 indicated that designing the website layout was difficult.

The data also demonstrated that rather than generalising, students were better equipped to communicate their challenges in terms of the criteria for a specific task. Participants 09 and 12 indicated that they experienced challenges in inserting the background picture into their websites. The tutorials did not have a section in which students were taught how to insert background pictures. They were expected to research how they could enhance the look of their projects. Ptp23 also mentioned that creating an interactive website was most challenging for her in this assignment. The participants faced creativity-related challenges. Creativity can be learned and developed over time. Students were encouraged to develop creative skills in modules that required them to design. It should be emphasised that students are required to seek content that will assist them in improving their creative talents for the HCI module.

Ptp30 stated that creativity was a challenge. The recommended software did not have a search button or the features that students needed to create interactive

forms. The software features were limited and only allowed students to create a mock-up or prototype of their design. Creating such a responsive website was beyond the scope of this study. The assignment aimed to understand and develop the concept of various web design elements as well as to explore how these elements may be integrated to create a website that meets the specifications given.

Ptp43 indicated that he was using this software for the first time. This indicated that the participant did not use the tutorial videos provided. This could also imply that some students were unable to learn by themselves. Practical classes must be structured in such a way that the lecturer goes through practical work with the students and assists where there are challenges.

The next section presents reflections on ***solving the challenging activities*** category.

7.6.5 Reflections from solving challenging activities category

In this category, students mentioned how they solved the problems they encountered (Section 8.6.4). Table 7.17 presents a summary of the responses from the participants and supporting guidelines.

Table 7.17: Supported guidelines from challenging activities' data

Data in support	Supported guidelines from Table 6.27
General advice to students to improve performance.	
Complete more practical work to solve the challenging activities.	No guideline
Read the theoretical content to solve the challenging activities.	IPG2: Students bridging the theory-practice gap
Research solutions to solve the challenges experienced.	IPG4: Research and understand the question
Manage time effectively in order to complete on time.	IPG3: Time management
Overall instructional design orientation.	
Watch tutorial videos to view how to solve the problem encountered.	IDG12: Online learning environments

Students will know exactly where they need to improve when they practice extra activities for their work. They learn more about the subject as they complete additional activities and improve their skills. Ptp14 indicated that he could improve on her weaknesses by performing more practical tasks. In addition to the regular activities that the students presently engage in, they are aware that when they engage in more activities, they will develop expertise in that area. Apart from improving their skills, they will also be in a position to assist other students experiencing difficulties in the same area. Therefore, it was suggested that HCI students should be given more tasks to complete to show them that they are capable of succeeding in and developing respect for HCI content as an activity.

Video tutorials were available for parts of the work that required knowledge of a specific area of study, theme, or concept, to help students with the requirements of their assignments. The videos were meant to encourage students to gain confidence when completing assignments from scratch and to improve their skills further when working on more complex parts of the assignment. They also provided them with the guidance they needed to start on their own. Ptp06 mentioned that she would watch the videos to catch up, while Ptp07 noted that the videos assisted him in comprehending what he needed to do during the assignment. As a result of the video tutorials, the students were able to learn about the software in their own time and then apply this knowledge to complete an assignment without any previous knowledge.

Some students used search engines such as Google because they had trouble solving particular challenges. According to Uppal *et al.* (2019), modern search engines, including Google and Yahoo, are not always capable of delivering precise answers to user queries with great efficiency. Students were required to examine and choose information relevant to their queries. In one of the responses, ptp10 said that they would use Google and other online resources to find information that would help them complete the assignment.

Some students mentioned getting assistance from a knowledgeable individual to help them with their challenges. Ptp27 stated that he would seek clarification from someone to make things easier. When students do not have enough time to

complete their assignments or do not understand them, they are likely to seek assistance. The problem that the students might be facing is insufficient knowledge about what to do, which makes it hard to come up with anything that stands out and conveys their message appropriately. For students to express themselves, they need a strong concept and solid strategy. This was especially true if they were unsure where to begin the assignment topic they wanted to explore.

Ptp23 also mentioned that he would do his best to enquire with the lecturer about the areas in which she needed support. When students were asked about areas which they did not understand, they indicated a desire for improvement. There is nothing wrong with students asking for clarity, as long as they can be provided with appropriate feedback. Students should not be provided with the answers nor have their assignments completed for them. The lecturer can demonstrate the solution by using an example similar to that of the assignment.

Table 7.18 presents the emerging possible intervention and a guideline for solving the challenging activities mentioned. Code EC2PI is used to refer to emerging cycle 2 possible interventions. Code EIPG refers to the emerging guidelines based on general advice to students to improve performance.

Table 7.18: Emerging possible interventions and guidelines for solving challenging activities

Additional possible intervention and guideline	
Possible intervention	New guideline
General advice to students to improve performance.	
EC2PI1: Ask students to complete practical examples and exercises to improve their practical skills.	EIPG1: Mastering practical work: Advise students to complete given examples and exercises to improve practical skills.

The next section presents reflections on the *knowledge application* category.

7.6.6 Reflections from the knowledge application category

In this category, students were asked how they were going to apply the knowledge or understanding they gained from the new assignment. Students recognised the significance of having a knowledge base for their future, and recognised that it may be a substantial source of revenue at some point in their lives, especially if they work with customers who require these types of services or if they provide these services themselves. A summary of the responses and supporting guidelines are presented in Table 7.19.

Table 7.19: Supported guidelines from the knowledge application data

Data in support	Supported guidelines from Table 6.27
General advice to students to improve performance.	
Reading the theoretical content assists in completing the assignment.	IPG2: Students bridging the theory-practice gap
Design skills have improved as a result of completing the assignment.	No guideline
Overall instructional design orientation.	
Gained the skill of creating websites for others.	IDG6: Theory-practice gap

Ptp07 mentioned that she would ensure that she understands the question and act to improve her understanding of design skills. By doing so, she was able to understand how to solve the problem based on the question provided and its context. Students were required to identify and understand the entire question and what critical information was required to provide an appropriate answer. There are numerous alternative solutions to the problem of the HCI practical component, which is dependent on personal preferences. Following a thorough examination of all relevant solutions, students were required to choose the best solution to the problem.

Ptp02 indicated that he was going to apply the knowledge gained from this module in a real-life setting by constructing his own website. He added that he had begun with

the prototype. This shows that the students recognised the value of starting with a functioning prototype before developing a website. Students who are building websites from scratch and discovering problems along the way can save time by choosing this method. The size of a prototype can be adjusted more easily than that of a website. Creating a prototype allows students to determine how their websites will look on different devices. It also helps in understanding how everything works. As a result, the students were able to focus on various aspects of web design that corresponded to their vision.

Ptp15 stated that in the future, after reflecting on the knowledge gained from the assignment and how she intends to use it, she will utilise the Pencil Project program to show the user how the website will appear, before she develops it. Ptp25 also stated that he would begin by planning the website before creating it. The pencil project program is free and may help students to create visually appealing and realistic designs. There is no need to invest money in software until the user approves the design. Before the students begin their web design tasks, they should ensure that they have a clear understanding of the website's content, style, and target audience. Later, the participants began working on an actual website design project after completing the prototype.

The possible interventions and guidelines that emerged from the data analysis are presented in Table 7.20.

Table 7.20: Additional guidelines from the knowledge application data

Additional possible intervention and guideline	
Possible intervention	New guideline
General advice to students to improve performance.	
EC2PI2: Construct practical exercises that are meaningful and motivating to students so they can learn and improve their design skills.	EIPG2: Improving design skills: Provide extra practical work to students in order to help them develop their design skills.

The next section presents reflections on the ***required resources*** category.

7.6.7 Reflections from the required resources category

The *required resources* category was intended for the students to reflect on the resources they needed to complete all the planned tasks they had for the assignment. The question was asked to determine what was needed to complete the assignment from the student's perspective. Having the necessary resources before beginning actual work may save a significant amount of time and effort. Students were expected to avoid wasting time and effort on something that may not even work out successfully after all their efforts. Students were required to ask themselves, *'What are the fundamental resources necessary to finish the assignment?'* A summary of the responses and supporting guidelines are presented in Table 7.21.

Table 7.21: Supported guidelines from the required resources data

Data in support	Supported guidelines from Table 6.27
General advice to students to improve performance.	
Use theory notes to complete the assignment.	C2IP_PI19
Use design expertise to create a website.	C2ID_PI9
Overall instructional design orientation.	
Use video tutorials to learn how to design a website.	C2ID_PI25 and C2ID_PI27
Use relevant content to use on the website.	C2TP_PI15

The students identified the different resources they were going to use in their assignments. One student noted that the required resources were pencil and paper to create a mock-up of their assignment, which would serve as a prototype for the actual website. The use of pencil and paper was an important resource before they committed to creating an actual website. Students will feel inadequate and confused if they do not have the necessary resources; thus, it is critical that they obtain them

ahead of time and properly understand the benefits of employing them in their website design assignment.

Some participants found it challenging to construct or design websites without computer hardware and design software. Ptp10 indicated that the required resources were laptops and software for the design. Students can design their website on a sheet of paper, but if they want to see how it will look in print or online, they need appropriate software and computer hardware.

Ptp09 stated that she wanted to watch videos and look at slides first. It was vital to understand the processes that followed to complete the assignment. If students did not have any guidance, the most common error was difficulty understanding how to start with a specific website design assignment. Video tutorials were uploaded to eThuto for students to learn how to create the prototype using the Pencil Project software. The video tutorials were also intended to assist them in their initial steps toward designing and in effective use of the software.

Ptp28 specified the Internet as a resource required to search for images to be used in the assignment. The Internet has become a significant tool for researching information, and some websites enable users to obtain photographs for use. Students were also required to use the Internet to gain access to module material placed on eThuto. The Internet has become a valuable resource for students to learn.

The next section presents a summary of the *specifying learning* phase.

7.6.8 Summary of specify learning phase

In this section, actual interventions are reviewed to evaluate their effectiveness from the lecturer's point of view. A "yes" indicates successful interventions, a "no" indicates unsuccessful ones, and "not sure" is used when the outcome is unclear. If the intervention was unsuccessful, a brief explanation was provided. Table 7.22 presents a summary of the specifying learning phase.

Table 7.22: Summary of the specifying learning (Cycle 2)

Actual intervention	Student's success from the Lecturer's perspective	Success in terms of guidelines
Setting a specific assignment to bridge the theory-practice gap.		
C2TP_AI3: Students were involved in a task that allowed them to do self-inquiry by making connections about what they had learned in theory to apply in practice.	Yes	Yes
C2TP_AI4: Students were asked to indicate how they applied what they had learned.	Yes	Yes
C2TP_AI5: Students were made aware of the different social conditions of the users they had to consider.	Yes	Yes
C2TP_AI6: HCI principles were taught, and examples were presented to the students on how to incorporate the principles into the practical work.	Yes	Yes
C2TP_AI7: Students were required to identify the HCI theoretical content they used in their assignment.	Yes	Yes
C2TP_AI8: Students were requested to brainstorm and sketch out their ideas.	Not sure – students indicated that they lack design skills	Yes
C2TP_AI9: The assignment required students to create a mock-up or prototype of a website;	Yes	Yes
C2TP_AI10: Students were advised to refine and iterate until the prototype was final and ready for submission.	Not sure – students were expected to submit only 7the final prototype	Yes
Guiding reflection by students		
C2RS_AI1: A case study of designing a website to promote one of the businesses specified or any interesting idea of their own that they would like to develop was provided.	Yes	Yes

Actual intervention	Student's success from the Lecturer's perspective	Success in terms of guidelines
C2RS_AI2: Students were given a reflective sheet to reflect on their learning to assess their prior knowledge.	Yes	Yes
C2RS_AI3: Students were asked to indicate how they applied what they had learned.	Yes	Yes
C2RS_AI4: In the reflective sheet, students were asked to identify the theoretical work related to the assignment they were completing.	Yes	Yes
General advice to students to improve performance.		
C2IP_AI1: The lecturer allowed students who were unable to come to campus to contact her via WhatsApp and email.	Yes	Yes
C2IP_AI2: The lecturer was available for a face-to-face consultation on days the students had practical classes on campus (Tuesdays, Wednesdays, and Thursdays).	Yes	Yes
C2IP_AI3: Students were reminded to follow the guidelines stated in the study guide for the assessments. CUT (2021:8) manual states <i>"Read the question carefully; make sure you know what is being asked"</i> .	Yes	Yes
C2IP_AI4: Students were advised to take note of the specifics of what they were being asked.	Yes	Yes
C2IP_AI5: Students were requested to use reputable sources when doing research.	No – some students used any available information from the internet	No
C2IP_AI6: Students were advised to follow the schedule provided in the study guide.	Yes	Yes
C2IP_AI7: Students were advised to start the task on time to be able to go through the theory.	Not sure – some students started very late to do the assignment	Yes

Actual intervention	Student's success from the Lecturer's perspective	Success in terms of guidelines
C2IP_AI8: Students were asked to draw up the plan on how they intended to complete the assignment.	Yes	Yes
C2IP_AI9: Activities that encourage students to conduct research about the work that they are doing were incorporated into the module in the form of an assignment.	Yes	Yes
C2IP_AI10: The lecturer observed the completion rate.	Yes	Yes
Assessment strategy to promote reflection.		
C2AS_AI1: Students were provided with a rubric to guide them on how they were going to be assessed.	Yes	Yes
C2AS_AI2: Formative assessments in the form of tests were used to provide feedback on learning.	Yes	Yes
C2AS_AI4: Detailed feedback was provided to the students to assist them in areas that needed improvement.	Yes	Yes
C2AS_AI5: Students were requested to complete the reflective sheets after receiving feedback on their work.	Yes	Yes
Overall instructional design orientation.		
C2ID_AI1: Lessons were related to the real-life experience that the students were able to relate to what they know.	Yes	Yes
C2ID_AI2: Lectures were recorded to allow students to access the session as needed.	Yes	Yes
C2ID_AI3: The students who were unable to attend due to a variety of circumstances were able to access the recorded session at any time.	Yes	Yes
C2ID_AI4: eThuto was used for students to access module content such as class presentations, tests, assignments, and classes.	Yes	Yes

Actual intervention	Student's success from the Lecturer's perspective	Success in terms of guidelines
C2ID_AI5: The assignment included key theoretical concepts based on the work that they were taught recently.	Yes	Yes

The focus of the second AR cycle was to improve the RP skills of the students and derive insights related to the guidelines for developing HCI students as reflective practitioners. The new possible interventions and guidelines that emerged from this cycle of data analysis are presented in Table 7.23. The guidelines were revised, and the two sets were combined, as they both conveyed the same concept.

Table 7.23: Consolidated guidelines (Cycle 2)

Additional possible interventions	Guideline	Consolidated guideline
General advice to students to improve performance.		
EC2PI1: Ask students to complete practical examples and exercises to improve their practical skills.	EIPG1: Mastering practical work: Advise students to complete given examples and exercises to improve practical skills.	IPG10: Enhancing design skills: Encourage students to enhance their design skills by diligently working through the provided examples, exercises, and supplementary practical assignments.
EC2PI2: Construct practical exercises that are meaningful and motivating to students so they can learn and improve their design skills.	EIPG2: Improving design skills: Provide extra practical work to students in order to help them develop their design skills.	

The next section presents the verification of the guidelines.

7.7 Verifying guidelines

This section provides a summary of the findings related to the guidelines in Table 7.24. The guidelines presented are intended to develop HCI students as reflective practitioners. The accuracy and validity of these guidelines were verified. The status of the guidelines is indicated as either requiring or not requiring further action, and new guidelines are also presented. The Table also presents the AR cycles for which the guidelines were verified. Reasons were provided for each guideline that could not be verified.

Table 7.24: Guidelines for developing HCI students as reflective practitioners (Cycle 2)

Guideline Code	Guideline	Status	Require further action
Setting a specific assignment to bridge the theory-practice gap.			
TPG1: HCI principles and goals	Assist students in using appropriate HCI principles and goals for the current context in their work to analyse, design, evaluate, and implement interactive systems for universal use.	Verified (Cycle 1)	No
TPG2: User's social context	Encourage students to incorporate reflective practices and consider the perspectives of users and their social context while creating designs and engaging with end users to broaden the scope of their research.	Not verified – Due to COVID-19, this guideline could not be implemented for students to meet with the users.	No
TPG3: External factors	Ask students to evaluate external factors that may affect individuals and practices.	Not verified – Due to COVID-19, this guideline was not tested as all students were affected by classes moving online.	No
TPG4: Linking theory with practice	Ask students to evaluate what they have learned through practice.	Verified (Cycle 1)	No

Guideline Code	Guideline	Status	Require further action
TPG5: Interactive lecture with a case study	Explore different ideas to make activities fun and involve the students in the learning process by assigning a case study based on theory work.	Verified (Cycle 1)	No
TPG6: User's role	Assist the students in developing a better understanding of the users' role in design.	Verified (Cycle 2)	No
TPG7: Prototyping	Ask students to develop physical prototypes to gain specific skills.	Verified (Cycle 1)	No
TPG8: User testing	Ask students to integrate activities such as user testing and those that involve what is done in the industry to enhance designs.	Not verified – students could not interact with users due to social distance restrictions that were put in place.	No
TPG9: Document experiences	Ask students to document successes and challenges that will need to be dealt with in decision-making and justification for a chosen process.	Verified (Cycle 1)	No
TPG10: Identifying additional confusing areas	After formative assessments students should be reminded to update their reflective documents to reflect additional learning experience.	Verified (Cycle1)	No
Guiding reflection by students			
RSG1: Reflective guidelines	Provide students with guidance on how to reflect on their studies.	Verified (Cycle 2)	No
RSG2: Prior knowledge	Provide students with an opportunity to reflect on their experiences in terms of their prior knowledge and knowledge gaps by adding reflection as a key process in their learning cycle.	Verified (Cycle 1)	No
RSG3: Critical	Encourage students to critically examine	Verified (Cycle 1)	No

Guideline Code	Guideline	Status	Require further action
skills	their own assumptions and those of the methods they chose.		
RSG4: Reflective Journal	Encourage students to maintain a reflective journal to become aware of their thoughts, feelings, and reactions to different situations.	Not verified – given the small number of participants, the researcher opted not to include an additional component that required students to reflect.	No
RSG5: Reflective skills	Develop specific skills to support various reflection strategies.	Verified (Cycle 1)	No
RSG6: Problem-solving skills	Develop a set of basic skills in order to suggest possible solutions from various perspectives.	Verified (Cycle 1)	No
RSG7: Reflecting on learning	Inspire students to add reflection as a key process in their learning cycle.	Verified (Cycle 1)	No
RSG8: Description of the event	Ask students to reflect on one event by describing their perceptions and not to make any judgments at this stage.	Verified (Cycle 2)	No
General advice to students to improve performance.			
IPG1: Question-answer session	Establish a platform that encourages students to ask questions about the parts of the work they find challenging.	Verified (Cycle 1)	No
IPG2: Students bridging the theory-practice gap	Request students to learn theory first in order to understand the practical component of the module.	Verified (Cycle 1)	No
IPG3: Time management	Guide students on how to break down abstract tasks to manage their time by providing them with a step-by-step process.	Verified (Cycle 1)	No

Guideline Code	Guideline	Status	Require further action
IPG4: Research and understand the question	Encourage students to seek more information about the topic and understand the question before attempting to answer it.	Verified (Cycle 1)	No
IPG5: Attending classes	Recommend to students to attend all scheduled theory and practical classes.	Verified (Cycle 1)	No
IPG6: Preparing for lecture	Advise students to prepare thoroughly for the lecture by reading the relevant section before attending.	Verified (Cycle 1)	No
IPG7: Studying after lecture	Advise students to review the section immediately after the lecture; before the next one.	Verified (Cycle 1)	No
IPG8: Completing assigned work	Advise students to complete all the assigned work.	Verified (Cycle 1)	No
IPG9: Acquiring correct answers	Encourage students to get accurate answers afterwards and have a thorough understanding of them.	Verified (Cycle 1)	No
IPG10: Enhancing design skills	Encourage students to enhance their design skills by diligently working through the provided examples, exercises, and supplementary practical assignments.	New guideline – the researcher was unable to confirm whether the students completed the examples and additional exercises.	No
Assessment strategy to promote reflection.			
ASG1: Monitoring reflection	Integrate reflection into students' work in a way that makes it possible to monitor that they engage in reflection.	Verified (Cycle 1)	No
ASG2: Evaluation standards	Develop a rubric to guide the students on how they will be assessed and to facilitate evaluation standards.	Verified (Cycle 1)	No
ASG3: Detailed	Provide students with detailed feedback	Verified (Cycle 1)	No

Guideline Code	Guideline	Status	Require further action
feedback	quickly to enable them to reflect on their assessed work and to make changes for further action.		
ASG4: Reflective practice strategy	Integrate reflective practice as a strategy to assist students in completing the work and to improve their learning.	Verified (Cycle 2)	No
ASG5: Post-lesson reflection	Provide students with a reflective sheet, allowing them to evaluate the knowledge they have gained during the lesson.	Verified (Cycle 1)	No
Overall instructional design orientation.			
IDG1: Enhance teaching quality	Reflect on lesson outcomes and acquire a variety of knowledge bases and models for teaching.	Verified (Cycle 1)	No
IDG2: Lecture method	Teach the theoretical content first for students to understand the practical component of the module, followed by practical classes in a lab.	Verified (Cycle 1)	No
IDG3: Presentation slides	Use presentation slides to conduct classes and give students an exercise to complete.	Verified (Cycle 1)	No
IDG4: Persona	Play the role of the persona to represent different user characteristics for the students to understand.	Not verified – the researcher was unable to role-play the persona due to online interaction with students.	No
IDG5: Pedagogical concept	Incorporate cross-disciplinary learning environments into classroom teaching and learning.	Verified (Cycle 1)	No
IDG6: Theory-practice gap	Incorporate practical experience based on theoretical knowledge to develop valuable industry-ready skills.	Verified (Cycle 1)	No

Guideline Code	Guideline	Status	Require further action
IDG7: User experience	Emphasise the importance of usability and user experience to students.	Verified (Cycle 1)	No
IDG8: Maximise students' potential learning	Customise learning by applying different strategies when teaching to accommodate individual needs.	Verified (Cycle 2)	No
IDG9: Co-teaching	Implement co-teaching to provide more hands-on support to students for their practical work.	Not verified – this could not be implemented because classes were not held face-to-face.	No
IDG10: Evaluate your own teaching	Use feedback from formative evaluation in the classroom to make adjustments for further action.	Verified (Cycle 1)	No
IDG11: Hybrid classes	Encourage students to attend theory classes online or face-to-face.	Not verified – students had the option of only attending classes online due to COVID-19.	No
IDG12: Online learning environments	Give students the opportunity to learn more effectively by interacting, collaborating, and taking responsibility for their learning through online learning environments.	Verified (Cycle 1)	No

Guidelines that were not verified could not be explored further because of the context of the study. Owing to the COVID-19 situation, the unverified guidelines were not suitable for the current context. Classes were held online, and therefore those guidelines could not be implemented.

The next section presents the limitations of the second AR Cycle.

7.8 Limitations of the second AR Cycle

There was a lack of engagement in online learning compared with face-to-face learning. For students who stayed in rural areas, there was a lack of network connectivity, making it difficult to communicate with them on time. WhatsApp was used to communicate instant messages, and those without data received information later when they were connected to the internet. A reliable Internet connection was needed for online classes, because students without reliable connections could not attend online classes consistently. The COVID-19 pandemic made it impossible for students to interact in physical settings.

In this AR cycle, recruiting as many participants as possible to complete the reflective sheet was hindered as a result of only communicating with the students online. The lecturer/researcher believes that participation would have improved if the students were attending physical classes.

The implementation of some guidelines was impacted by online learning, as face-to-face classes were necessary for their effective implementation.

The next section presents the summary of this cycle.

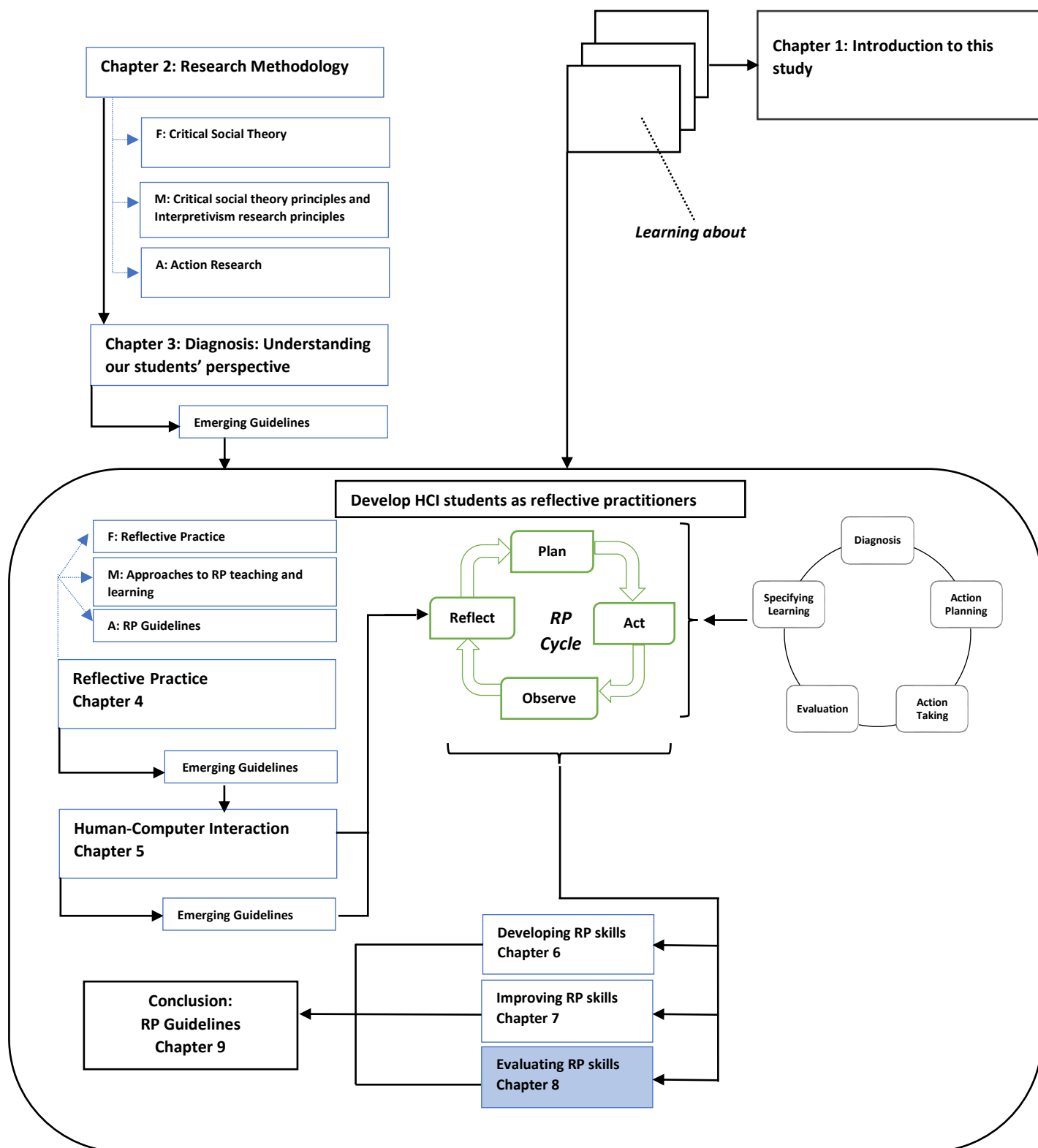
7.9 Chapter summary

The purpose of this chapter was to employ the reflection-in-action approach as a means of assisting HCI students in developing as reflective practitioners. The diagnosis phase began with the first-cycle findings, and the proposed interventions were utilised to plan the intervention. The interventions were integrated during the contact sessions before the students started their assignments.

During action-taking, the action plan was carried out exactly as specified. Students were evaluated once they started the assignment and were given a reflective sheet to reflect on the actions they were undertaking. The data indicated that the students were able to employ several approaches to solving the problems they experienced while completing the assignment. The data also indicated that the students used the information they received during the intervention talk to improve their RP skills. The data further revealed that students should give themselves sufficient time to complete their assignments effectively. The AR cycle concluded with the specifying

learning phase by reflecting on each category. This chapter presented the guidelines to be followed when developing the HCI students as reflective practitioners. The guidelines were verified, and limitations of the AR cycle were presented.

The next AR cycle, whose purpose is to determine whether the interventions assisted the participants in their development as reflective practitioners, is discussed in the next chapter.



CHAPTER 8: EVALUATING REFLECTIVE PRACTICE SKILLS

8.1 Introduction

The primary objective of this study is to formulate guidelines for developing human-computer interaction (HCI) students as reflective practitioners.

In this chapter, the third action research (AR) cycle of this study is presented with the aim of evaluating whether students were developing as reflective practitioners. Section 8.2 presents the guidelines that were not verified in the second AR cycle in the diagnosis phase. A possible intervention strategy provided during the action-planning phase is presented in Section 8.3. Section 8.4 outlines the implementation of the action-taking phase of the third AR cycle to evaluate whether the students developed into reflective practitioners.

Section 8.5 describes the process of collecting data from the participants, which was used to evaluate and assess the reflective practice (RP) skills of the students. Data were analysed using the content analysis approach described in the methodology chapter of Section 2.4.9. The findings are then presented. Section 8.6 presents the summary of the knowledge gained in this cycle in the “*specify learning*” phase of the AR cycle. In this phase, reflections were made on the findings for each category. Section 8.8 presents the limitations of the third AR cycle. Finally, conclusions are presented in Section 8.2.

8.2 Diagnosis phase

This cycle is a follow-up iteration of the previous AR cycles to determine whether the students are developing as reflective practitioners. The researcher sought to investigate the changes that had taken place in the students' experiences with RP over the course of approximately one year since they participated in a reflective practice exercise. The diagnosis of this cycle was based on the first and second AR cycles, which took place in the previous year. The second cycle concluded with guidelines that were verified and those that were not verified. The researcher did not have any direct interaction with the students during this third AR cycle. The students

were in their third year of study and had completed the HCI module the previous year.

The study involves creating guidelines to develop reflective skills among HCI students and empowering them by fostering their development as reflective practitioners. Since the guidelines could not be verified any further, the diagnosis focused on evaluating the reflective skills of the students who participated in previous AR cycles (Cycle 1 and Cycle 2).

Table 8.1 presents the findings from the second AR Cycle (Table 7.24). Guidelines that were verified and required no further actions are not repeated. The unverified guidelines copied from the second iteration (AR cycle 2) are provided, but they are not used to diagnose the problem, since they are not suitable for the specific application.

Table 8.1: Guidelines not verified (Diagnosis Cycle 3)

Guideline Code	Guideline	Status	Require further action
Setting a specific assignment to bridge the theory-practice gap.			
TPG2: User's social context	Encourage students to incorporate reflective practices and consider the perspectives of users and their social context while creating designs and engaging with end users to broaden the scope of their research.	Not verified	No
TPG3: External factors	Ask students to evaluate external factors that may affect individuals and practices.	Not verified	No
TPG8: User testing	Ask students to integrate activities such as user testing and those that involve what is done in the industry to enhance designs.	Not verified	No
TPG10: Identifying additional confusing areas	After formative assessments, students should be reminded to update their reflection documents to reflect additional learning experiences.	Not verified	No
Guiding reflection by and among students.			
RSG4: Reflective Journal	Encourage students to maintain a reflective journal to become aware of their thoughts, feelings, and	Not verified	No

Guideline Code	Guideline	Status	Require further action
	reactions to different situations.		
General advice to students to improve performance.			
IPG10: Enhancing design skills	Encourage students to enhance their design skills by diligently working through the examples, exercises, and supplementary practical assignments provided.	Not verified	No
Assessment strategy to promote reflection.			
ASG5: Post-lesson reflection	Provide students with a reflective sheet, allowing them to evaluate the knowledge they have gained during the lesson.	Not verified	No
Overall instructional design orientation.			
IDG4: Persona	Play the role of the persona to represent different user characteristics for the students to understand.	Not verified	No
IDG9: Co-teaching	Implement co-teaching to provide more hands-on support to students for their practical work.	Not verified	No
IDG11: Hybrid classes	Encourage students to attend theory classes online or face-to-face.	Not verified	No

The next section presents the action planning phase of the third AR cycle. The interventions implemented in Cycle 1 and Cycle 2 were used as a guide to assess the RP skills of the participants. Specific intervention strategies were proposed for each implemented intervention during the planning phase.

8.3 Action planning phase

In this section of the action planning phase, plans were developed to follow up on the previous AR cycles' intervention plans to determine whether the students are developing as reflective practitioners. The action planning phase started during the first semester when the researcher identified the Lecturers who had direct contact with students to establish communication with the participants. A plan for a reflective practice (RP) recap video was created for the students. The researcher looked at

what the students had done in the previous cycles and planned the topics to be included in the video.

The actual interventions from the previous AR cycles (Cycle 1 and Cycle 2) served as a guide for action planning during this cycle. The possible interventions for this AR cycle have been listed alongside the actual interventions from previous AR cycles (with original codes). The use of actual interventions allowed students to reflect on what was achieved in terms of RP. The action plans for this cycle are listed in Table 8.2. Code C3 is used to refer to Cycle 3 and PI for possible intervention.

Table 8.2: Possible interventions to evaluate reflective skills (Cycle 3)

Possible intervention	Reference from Cycle 1 and Cycle 2
Setting a specific assignment to bridge the theory-practice gap.	
C3TP_PI1: Find out if the reflective sheet helped the participants in making connections between the theory they had learned and the practical assignment.	C2TP_AI1: Students were involved in a task that allowed them to do self-inquiry by making connections between the theory they had learned and the practical assignment.
C3TP_PI2: Ask participants whether indicating how they applied what they had learned has assisted them in gaining more knowledge.	C2TP_AI2: Students were asked to indicate how they applied what they had learned.
C3TP_PI3: Inquire of the participants if the instances shown on how to integrate the principles into their tasks were helpful.	C1TP_AI1: HCI principles were taught, and examples were made on how to incorporate them into the practical work.
C3TP_PI4: Ask participants if identifying users of the system assisted them.	C1TP_AI2: Students were asked to identify users of the system in the assignment.
C3TP_PI5: Ask participants if they were aware of the different social conditions of the users to consider during their designing process.	C1TP_AI3: Students were made aware of the different social conditions of the users to consider.
C3TP_PI6: Inquire whether it was advantageous for the participants to demonstrate their understanding of the current work.	C1TP_AI4: A case study was provided for the students to demonstrate their understanding of the current work.
C3TP_PI7: Find out if the participants can brainstorm various methods for constructing a prototype	C1TP_AI5: Students were requested to brainstorm and sketch out their ideas.

Possible intervention	Reference from Cycle 1 and Cycle 2
C3TP_PI8: Inquire if the participants have the capability to develop a model that accurately depicts the actual system.	C1TP_AI6: Students were given an assignment that required them to create a prototype.
C3TP_PI9: Find out from the participants if they are capable of improving and revising their prototype until it is complete and suitable for submission.	C1TP_AI7: Students were advised to refine and iterate until the prototype was final and ready for submission.
C3TP_PI10: Request participants to evaluate if they are incorporating the theoretical concepts and design principles in their work.	C1TP_AI8: Students were required to identify the HCI theoretical content they used in their assignment.
Guiding reflection by and among students.	
C3RS_PI1: Ask participants to formulate and write a plan on how they are going to apply what they have learned.	C1RS_AI2: Students were asked to indicate how they applied what they had learned.
C3RS_PI2: Find out if the participants were able to evaluate their prior knowledge and identify knowledge gaps using a reflective sheet.	C2RS_AI1: Students were given a reflective sheet to reflect on their learning to assess their prior knowledge.
General advice to students to improve performance.	
C3IP_PI1: Ask participants if being reminded to follow the guidelines stated in the study guide for the assessments assisted.	C1IP_AI1: Students were reminded to follow the guidelines stated in the study guide for the assessments. CUT (2021:8) manual states <i>"Read the question carefully; make sure you know what is being asked."</i>
C3IP_PI2: Find out from the participants if they were following the instructions given to complete the assignment.	C1IP_AI2: Students were advised to take note of the specifics of what they were being asked.
C3IP_PI3: Ask participants if they were successful in employing the schedule in the study guide to allocate their time effectively.	C1IP_AI3: Students were requested to follow the schedule provided in the study guide.
C3IP_PI4: Inquire if the participants understand the importance of starting the task on time to minimise distractions and procrastination.	C2IP_AI7: Students were advised to start the task on time to be able to go through the theory.
C3IP_PI5: Inquire of the participants if they plan in	C2IP_AI8: Students were asked to draw up the

Possible intervention	Reference from Cycle 1 and Cycle 2
advance how they will complete the work given.	plan on how they were planning to complete the assignment.
C3IP_PI6: Find out if the participants are researching the required information to use in their work.	C1IP_AI4: Activities that encourage students to conduct research about the work that they are doing were incorporated into the module in the form of an assignment.
C3IP_PI7: Ask participants if knowing the due date assisted them in completing the task on time.	C1IP_AI5: The due date was announced during class and also stipulated in the assignment.
C3IP_PI8: Inquire from the participants if they are using reputable sources when conducting research on the Internet.	C1IP_AI6: Students were advised to use reputable sources when researching.
C3IP_PI9: Ask participants if contacting the lecturer via WhatsApp and email has assisted them.	C1IP_AI7: The lecturer allowed students who were unable to come to campus to contact her via WhatsApp and email.
C3IP_PI10: Inquire from participants if they consulted the lecturer face-to-face on days when the students had main module practical classes on campus.	C1IP_AI8: The lecturer was available for face-to-face consultations on days when the students had main module practical classes on campus (Tuesdays, Wednesdays, and Thursdays).
Assessment strategy to promote reflection.	
C3AS_PI1: Ask participants whether being provided with a rubric assisted with what was expected of them and how their work was going to be assessed.	C1AS_AI1: Students were provided with a rubric to guide them on how they were going to be assessed.
C3AS_PI2: Inquire from the participants if the feedback they received on their work encouraged them to reflect.	C1AS_AI2: Formative assessments (quizzes, tests, etc.) were used to provide feedback on learning.
	C1AS_AI3: Detailed feedback was provided to the students to assist them in areas that needed improvement.
	C1AS_AI4: Students were requested to complete the reflective sheet after receiving feedback on their work.
C3AS_PI3: Ask students if they regularly reflect on their academic work.	C1AS_AI5: Students were advised to regularly reflect on their work.

Possible intervention	Reference from Cycle 1 and Cycle 2
Overall instructional design orientation.	
C3ID_PI1: Request feedback on how participants plan to utilise the knowledge gained to further their professional development.	IDA11: Lessons were related to the real-life experience that the students were able to relate to what they know.
C3ID_PI2: Inquire if the participants watched the tutorial videos that were provided for their use.	IDA12: Lectures were recorded to allow students to access the sessions as needed.
	IDA13: The students who were unable to attend due to a variety of circumstances were able to access the recorded sessions at any time.
C3ID_PI3: Ask participants if the activities related to the theoretical content that they were taught assisted them in their understanding.	IDA14: Students were given a practical activity to apply and gain a better understanding of the theoretical content they were taught.
C3ID_PI4: Ask participants whether the use of LMS assisted in their learning.	IDA15: eThuto was used for students to access module content such as class presentations, tests, assignments, and classes.

The next section presents the action-taking phase of the third AR cycle.

8.4 Action-taking phase

In this section of the action-taking phase, the proposed interventions were documented as specified in the preceding section on action planning. A follow-up interview was conducted to determine whether the students developed as reflective practitioners.

The action-taking phase started with the RP video created by the researcher as presented in Section 8.4.1 and conducting the interviews thereafter as presented in Section 8.4.2.

8.4.1 Reflective practice video recap

The action-taking phase began during the first semester, with the researcher creating a reflective practice recap video for the students. Since the researcher did not have access to the modules that the students were enrolled in, 3rd-year lecturers

were asked to place the video on the university's learning management system (eThuto). This took place in May 2022, which was towards the end of the first semester. An announcement was posted along with a reflective video. This allowed the students to access the video whenever they needed. The contents of the video are presented in Table 8.3.

Table 8.3: Video contents of AR cycle 3

The video included	Linked to possible interventions from Table 8.2
What is Reflective Practice	C3AS_PI1
What does RP involve	C3RS_PI3
Review what was done in the HCI module	C3TP_PI2
Importance of identifying users	C3TP_PI4
Importance of HCI goals in the design	C3TP_PI10
Bridging the theory-practice gap	C3TP_PI4
Reflection about applying theory in practical work	C3TP_PI10
Reflection about what would students do differently if they were to repeat the HCI module	C3AS_PI3
Benefits of reflection	C3AS_PI4
What questions to ask oneself during the reflection process	C3TP_PI6
A reminder that reflection is an ongoing process	C3TP_PI3

During the second semester, when students were doing the work-integrated learning module, the video was posted once more since they did not have access to module contents of the first semester on eThuto. The following section presents the interviews as a means of action-taking.

8.4.2 Action-taking - Interviews

A class list of students registered for the module was requested. The researcher went through the list to compare it with the list of the participants in the first and second AR cycles. Only those who participated in either one or both cycles were invited to participate in interviews. The interviews were held from October 2022 to February 2023. It was challenging for some participants to attend the face-to-face interviews. One participant had health issues that made it difficult to participate in the interviews. After recovery, she was able to attend an interview. Another participant studied from home and was based in another province far from the university. The participant returned at the beginning of the new year to resolve registration issues and the interview was conducted in February 2023. The contents of the interviews are presented in Table 8.4 with reference to the possible interventions presented in the previous section.

Table 8.4: Action-Taking (Cycle 3)

Action-taking	Possible intervention reference from Table 8.2
Setting a specific assignment to bridge the theory-practice gap.	
C3TP_AI1: Asked participants whether it was beneficial to use theoretical work to complete the practical assignment	C3TP_PI1
C3TP_AI2: Observed from the responses if participants were able to choose relevant content for their practical designs	C3TP_PI1
C3TP_AI3: Asked participants whether they were currently planning before completing any assessment or do they continue to carry out activities as previously	C3TP_AI3
C3TP_AI4: Asked participants what they would do differently if they were to repeat the HCI module	C3TP_PI10
Guiding reflection by and among students.	
C3RS_AI1: Checked if the students are still involved in practical work with challenging activities	C3RS_PI1

Action-taking	Possible intervention reference from Table 8.2
C3RS_AI1: Asked participants whether they were able to improve their problem-solving abilities because of the reflective practice exercise	C3RS_PI2
General advice to students to improve performance.	
C3IP_AI1: Asked participants how understanding the question assisted them during the assessments	C3IP_PI1
C3IP_AI2: Identified if the participants are following the instructions given to complete the assignment	C3IP_PI2
C3IP_AI3: Determined if the participants are researching the required information to gather information to use in their work	C3IP_PI6
C3IP_AI4: Established if the participants are able to manage their time	C3IP_PI3
Assessment strategy to promote reflection.	
C3AS_AI1: Asked participants what their understanding of the concept of reflective practice is	C3AS_PI3
Overall instructional design orientation.	
C3ID_AI1: Asked participants how they would apply what they have learned to advance their careers	C3ID_PI1
C3ID_AI2: Determined if the participants were watching the tutorial videos that were made available to them	C3ID_PI2

The next section presents the evaluation phase.

8.5 Evaluation phase

The purpose of the evaluation phase was to assess whether empowerment took place among the participants by developing RP skills. The data obtained from participants were used to test the participants' RP skills. The evaluation report includes biographical information on the participants, as outlined in Section 8.5.1. Section 8.5.2 presents how data were collected for the cycle and analysed. Section

8.5.3 presents the perspectives of the participants and the researcher, leading to the drawing of conclusions.

8.5.1 Participants' biographical details

During this cycle, the participants were registered for the second semester of the Work Integrated Learning module (ITC327W) at the third-year level of study. ITC327W was the only module that ran during the second semester. The students were expected to complete a project which integrated all modules that they had done previously. There were 23 students registered for the module because of the students' unrest that took place during the first-semester exam. Most students did not write exams and did not qualify for ITC327W because they did not have the required prerequisites from the first semester. All students who participated in Cycle 1 (*Chapter 6*) and/or Cycle 2 (*Chapter 7*) were invited to participate in this study. Only six students qualified with four students who participated in both cycles, and two students participated in one cycle. The two students who participated in only one cycle did not respond to the invitation sent out and therefore, did not participate in the interviews. The four students who participated in both cycles were interviewed. The interviews took place face-to-face. The participants were asked to sign the consent form before an interview took place. The demographics of the students in this cycle are presented in Codes were used to maintain the participants' anonymity and privacy, as indicated in the ethics section in Chapter 2 (Section 2.7). The code *ptp* was used to refer to the participants.

Table 7.5, grouped by age and gender. The data indicated that there were two males and two females with ages ranging from 21 to 26 years. Codes were used to maintain anonymity and privacy of the participants, as indicated in the ethics section of Chapter 2 (Section 2.7). Code *ptp* is used to refer to the participants.

Table 8.5: Cycle 3 participants' profiles

Age	Gender	Participants	Total
21 - 23	M	<i>ptp01</i>	<i>1</i>
	F	<i>ptp04</i>	<i>1</i>
24 - 26	M	<i>ptp02</i>	<i>1</i>
	F	<i>ptp03</i>	<i>1</i>
Total			4

The next section presents a data analysis of the third AR cycle.

8.5.2 Data analysis

8.5.2.1 Preparing the data

The collected data were transcribed using Descript software and prepared for use in Atlas.ti.

8.5.2.2 Defining the unit of analysis

To describe the data, the unit of analysis is based on each response to the question. Respondents were asked the same questions during the interviews. An in-depth analysis of each response was conducted, followed by extensive interpretation of the data. Categories and coding schemes were developed by defining the units of analysis. To obtain a better perspective of the answers, the fundamental principle of the hermeneutic cycle is described in Section 3.4.4.3.

8.5.2.3 Developing categories and coding consistency

The codes were used to offer a brief explanation of the data, and categories were formed to provide significance to the codes. Codes that contributed to the same context or meaning were grouped into categories. A sample of the categories formed during the analysis is shown in Figure 8.1.

Name	Grounded	Groups
○  Developed into a reflective pr...		4 [Developing into a reflective practitioner]
○  Self awareness		1 [Developing into a reflective practitioner]
○  Reflect on work done		1 [Developing into a reflective practitioner]
○  Gather thoughts first		1 [Developing into a reflective practitioner]
○  Plan first		5 [Developing into a reflective practitioner] [Planning first]

Figure 8.1: Display of Developing into reflective practitioner category

8.5.2.4 Testing the coding scheme on a sample

In this step, a unit of analysis, such as a piece of text, is coded. A response from one of the questions was utilised as a sample for the question, serving as the unit of analysis for this process.

Code extract 8.1: What is your understanding of the concept of reflective practice?

Response	Codes
<i>Ptp01: Reflective practice to me means looking back at your work, uh, especially after receiving your marks, after you've been graded to check, what were the errors you may have made and improved on that for the next assignment or tasks that you might have on that.</i>	Looking back; Improving next time
<i>Ptp03: Reflecting on what has been taught and the application of that.</i>	Applying what was taught
<i>Ptp04: It's about thinking about your experiences and, um, making efforts to learn.</i>	Thinking of your experiences; Effort to learn

8.5.2.5 Coding all text

Codes were created based on the data supplied by the participants. The complete text was coded for each text. Each data item was evaluated to determine the code that best described it. Categories were generated on the basis of the patterns

discovered in the codes. The entire text was coded as indicated in Figure 8.2 and presented alphabetically according to the categories.

Name	Grounded	Groups
○  Stepping stone		1 [Application of the theory]
○  Self-awareness		2 [Application of the theory]
○  Theory assisted		4 [Application of the theory]
○  How to answer a question		1 [Challenges experienced]
○  Understand the requirements		1 [Challenges experienced]
○  Don't recall challenges		1 [Challenges experienced]
○  Being creative		1 [Challenges experienced]
○  Reading the question correctly		1 [Challenges experienced]
○  Understand the question		3 [Challenges experienced] [Problem-solving abilities]
○  Gather thoughts first		1 [Developing into a reflective practitioner]
○  Reflect on work done		1 [Developing into a reflective practitioner]
○  Developed into a reflective pra...		4 [Developing into a reflective practitioner]
○  Plan first		5 [Developing into a reflective practitioner] [Planning first]
○  Input on mistakes		1 [New plan]
○  Enjoy the module		1 [New plan]
○  Consult lecturer		1 [New plan]
○  Pay attention to principles		1 [New plan]
○  Pay attention to the work given		1 [New plan]
○  Dedicated to studies		1 [New plan]
○  Rectify mistakes		2 [New plan] [Problem-solving abilities]
○  Summarise main idea		1 [Planning first]
○  Use reflective practice		2 [Planning first]
○  Use HCI principles		4 [Planning first] [Problem-solving abilities]
○  Use experience		1 [Problem-solving abilities]
○  Rectify color scheme		1 [Problem-solving abilities]
○  Use rubric		1 [Problem-solving abilities]
○  Reflect on improving		1 [Problem-solving abilities]
○  Apply Gelstat principles		1 [Problem-solving abilities]
○  Use new approach		1 [Problem-solving abilities]
○  Reflect on ideas		1 [Problem-solving abilities]
○  Apply in the job market		1 [Reflective practice application]
○  Analyse problems		1 [Reflective practice application]
○  Plan thoroughly		1 [Reflective practice application]
○  Reflect to improve		1 [Reflective practice application]
○  Apply HCI theory to design		1 [Reflective practice application]
○  Gain better understanding		1 [Understanding of the question]
○  Reflect on the question		1 [Understanding of the question]
○  Link theory with practice		1 [Understanding of the question]

Name	Grounded	Groups
○ ◇ Helped with keywords		1 [Understanding of the question]
○ ◇ Answer question correctly		1 [Understanding of the question]
○ ◇ Effort to learn		1 [Understanding the reflective practice concept]
○ ◇ Thinking of your experience		1 [Understanding the reflective practice concept]
○ ◇ Combining ideas		1 [Understanding the reflective practice concept]
○ ◇ Applying what was taught		1 [Understanding the reflective practice concept]
○ ◇ Observing your actions		1 [Understanding the reflective practice concept]
○ ◇ Improving next time		1 [Understanding the reflective practice concept]
○ ◇ Looking back		2 [Understanding the reflective practice concept]

Figure 8.2: Coding all text

8.5.2.6 Assessing consistency

Coding was carefully reviewed for correctness by repeating it twice. The process was applied to each response to check whether the code was suitable for the data item. Where revisions were required, they were implemented immediately to ensure that no code was skipped during the process. The next section presents the conclusions drawn from the data.

8.5.3 Drawing conclusions from the data

This phase entails making sense of all recognised categories. The researcher determined the key categories reflected in the data. Each category was examined to obtain the meaning from the data. From the collected data, nine categories were established to help with the goal of the research: *understanding the reflective practice concept, new plan, problem-solving abilities, understanding of the question, application of the theoretical content, challenges experienced, planning first, reflective practice application, and developing into a reflective practitioner*. These categories are discussed in the following subsections.

8.5.3.1 Understanding the reflective practice concept category

In this section, participants were asked about their understanding of the concept of reflective practice. The responses were coded as described in Table 8.6.

Table 8.6: Summary of understanding the reflective practice concept codes

Code No.	Code	Frequency
1.	Applying what was taught	1
2.	Combining ideas	1
3.	Effort to learn	1
4.	Improving next time	1
5.	Looking back	2
6.	Observing your actions	1
7.	Thinking of your experience	1

The ***understanding of the reflective practice*** (RP) concept category for HCI participants can be summarised as follows:

- Participants noted that RP is a retrospective examination of their own work. *“Reflective practice to me means looking back at your work, uh, especially after receiving your marks, after you’ve been graded to check, what were the errors you may have made and improved on that for the next assignment or tasks that you might have on that (ptp01)”*.
- Participants understood RP as a method to use and think about how they were to implement it in various ways. *“Reflect on how we approach, um, what we implement (ptp02)”*.
- The participants’ understanding of RP was that it meant looking back at what they had been taught and how to apply it. *“Reflecting on what has been taught and the application of that (ptp03)”*.
- Participants understood that RP means thinking about one’s experiences and applying oneself to acquire knowledge. *“It’s about thinking about your experiences and, um, making efforts to learn (ptp04)”*.

The participants provided different responses regarding their understanding of RP. In short, it was defined as looking back at one’s experience and seeking ways to improve.

The next section presents the **new plan** category.

8.5.3.2 New plan category

In this section, participants were asked what they would do differently if they were to repeat the HCI module. This was to determine if the participants had learned anything as a result of RP that they thought they were going to do differently if they were to repeat the module. The responses were coded as shown in Table 8.7.

Table 8.7: Summary of the new plan codes

Code No.	Code	Frequency
1.	Consult lecturer	1
2.	Dedicated to studies	1
3.	Enjoy the module	1
4.	Input on mistakes	1
5.	Pay attention to principles	1
6.	Pay attention to the work given	1
7.	Rectify mistakes	1

The **new plan** category for HCI participants can be summarised as follows:

- The participants' revised strategy was to enquire more about the HCI principles they apply in their work. *"I think I would consult with my lecturer more to get more input on what I have done wrong regarding using the principles of human-computer interface and using it to design my work" (ptp01).*
- Participants indicated that they intended to be more attentive to principles that guide them in their design process. *"If I were to repeat it, I would pay attention more, um, to the principles that guide, um, like designing interfaces" (ptp02).*
- Participants pledged that they would prioritise the users' ease of use when applying the principles that govern how to structure and design, which forms the foundation of design theory. *"In other modules that we are designing, we are presented with an opportunity to design a very easy-to-use interface, but you find that now many people, especially in our group, don't know certain ways of*

structuring the page so that it's easy to use. "I'll really pay more attention to ease of use for the user on the principles that guide on how to structure such, which is actually the theory behind designing" (ptp02).

- Participants expressed their intention to focus more on the given work, avoid working under pressure, and endeavour to enjoy the process. *"I think I will pay more attention to the work that was given because I feel like I, I did most of the work under pressure, so it was more about finishing the work and handing it in instead of, um, instead of enjoying it because it's a very, you know, it's an enjoyable module" (ptp03).*
- Participants communicated their commitment to being dedicated to their work and rectifying their mistakes. *"I think I will be more committed to it because I think that I did not study enough. The mistake that I have made if I can redo it, I can make sure that those mistakes do not happen" (ptp02).*

The findings revealed that participants were keener about applying the correct HCI principles in their work. They mentioned that they would prioritise the use of the HCI principles in their work. The next section presents the **problem-solving abilities** category.

8.5.3.3 Problem-solving abilities category

In this section, the participants were asked whether they were able to improve their problem-solving abilities through the reflective practice exercise. The participants were also asked to elaborate on their answers. The responses were coded, as illustrated in Table 8.8.

Table 8.8: Summary of problem-solving abilities codes

Code No.	Code	Frequency
1.	Apply Gelstat principles	1
2.	Rectify colour scheme	1
3.	Rectify mistakes	2
4.	Reflect on ideas	1
5.	Reflect on improving	1
6.	Understand the question	3

Code No.	Code	Frequency
7.	Use experience	1
8.	Use HCI principles	2
9.	Use new approach	1
10.	Use rubric	1

The HCI participants' responses in **problem-solving abilities** category can be summarised as follows:

- The participants believed that reflective practice (RP) had enhanced their problem-solving abilities, as they realised that they could improve their work. *"Yes, I believe I, it has improved my studies. Um, for example, my, uh, banner I created, um, in my, when I did the subject, uh, I used a bit of a wrong colour scheme. Uh, I, I could have worked better" (ptp01).*
- Upon reflection, the participants realised that they had made significant improvements in integrating symmetry into their designs. *"Where I'm sitting now at the moment, If I check my work to my previous years, I've definitely improved in integrating symmetry into my design" (ptp04).*
- Participants indicated that they applied the knowledge acquired from the HCI module to their work in other modules. *"I found myself using my experience in the current module because I'm using HCI principles" (ptp02).*
- The initial reflective practice exercise in Cycle 1 helped participants reflect on the errors made in the assignment. *"Yes, comparing the two assignments that were given. First, by checking the rubric and the reflective practice, um, exercise, I understood that there were certain things that I needed to improve on and one of them was understanding the questions, the question that needed to be answered, um, how to answer them" (ptp03).*
- Participants stated that reading and comprehending the question thoroughly improved their performance in the second assignment. *"Thorough reading through the question with understanding, because I applied that in the second assignment, and I did much better compared to the first one" (ptp03).*

- As a result of the reflective practice exercise, the participants indicated that they were able to rectify some of the mistakes they had made in other modules. *“Yeah, I did to other modules because eh, I managed to fix some mistakes that I did. But yeah, although there are some that I could not fix, I am still working on that” (ptp04).*

The results showed that the problem-solving abilities of participants improved. They provided examples of how their work improved during the second assignment. The next section presents the ***understanding of the question*** category.

8.5.3.4 Understanding of the question category

In this section, the participants were asked how their understanding of the questions assisted them during the assessments. Understanding of the question was mentioned in the previous cycles as a technique to assist during assessments. The question was asked to establish whether this technique assisted the participants in writing the assessments. The responses were coded accordingly as shown in Table 8.9.

Table 8.9: Summary of understanding of the question codes

Code No.	Code	Frequency
1.	Answer question correctly	1
2.	Gain better understanding	1
3.	Helped with keywords	1
4.	Link theory with practice	1
5.	Reflect on the question	1

The HCI participants' responses in the ***understanding of the question*** category can be summarised as follows:

- The participants noted that the keywords helped them to understand the question. *“I knew what keyword words to look out for, to link it, to note to the theory work that I studied to help use it as a whole in my design” (ptp01).*

- The participants did not want to assume, but to make sure that they understood what was being asked of them. *“That emphasis makes me very aware to say what is it that I’m actually doing or what has been asked of me so that maybe I don’t assume what’s not asked of me. Therefore, it is more precise and accurate to like the information that is elicited, um, from the question”* (ptp02).
- Participants stated that understanding a question gave them clarity on what needed to be done. *“It gave me a better understanding of what I actually need to do”* (ptp03).
- Participants stated that reflecting on the question assisted them in understanding what was required of them. *“When the first assignment came, uh, it was about, okay, I read the question quickly, do it, finish, submit, but on the second assignment, it was different, I had to reflect on the question. So that’s where the reflective practice came into consideration because I had to read the question, understand what’s required of me, see the problem as a whole, and not just as individual questions, but what is the main goal, um, after the assignment is finished.”* (ptp03).
- Participants acknowledged that not understanding the question was a problem, and therefore understanding the question greatly assisted them. *“It did assist me a lot because it’s really a problem not to understand the question”* (ptp04).
- Participants realised that incorrect reading of the question could lead to a misunderstanding of what is required. *“Sometimes you, you want to answer your question, but you think you are being asked something else, although you know the answer, you do not understand that you know the answer because you read the question incorrectly”* (ptp04).
- Participants believed that taking the time to read the question correctly helped them to understand what was required. *“If you take time, you read the question correctly, you get to understand the question”* (ptp04).

The participants realised that not understanding the question could be a problem. They noted that they did not want to assume that they had understood the question. The next section presents an **application of the theoretical content** category.

8.5.3.5 Application of the theoretical content category

In this section, participants were asked whether it was beneficial to apply theoretical work to complete the practical assignment. The participants were also asked to explain their answers. The purpose of the question was to determine whether the students applied the theory they had learned in their practical work. The participants provided various responses on how they used theoretical work in their assignments. The responses were coded as shown in Table 8.10.

Table 8.10: Summary of the application of theory codes

Code No.	Code	Frequency
1.	Self-awareness	2
2.	Steppingstone	1
3.	Theory assisted	4

The responses of HCI participants in the ***practicality of the theory*** category can be summarised as follows:

- The HCI participants indicated that theory had been instrumental in guiding them to apply what they have learned in other modules, thereby assisting them in their work. *“Yes. I think the theoretical aspect has helped me. Um, by nature, I am guided by and study theoretical principles, and I like to do my work exactly to what I have learned in theory and especially software development” (ptp01).*
- Participants stated that they appreciated the benefits of applying the HCI theory to their work. *“I see the advantages of knowing the higher, or should I call it the lower level, uh, the perspective of knowing this theory and designing your work from that” (ptp01).*
- Participants observed that the designs they created in the other modules depended heavily on the content they learned in HCI. *“Yes, definitely it was, it was, um, as I'd mentioned before, we are doing like, um, other modules that borrow a lot from design work or human interactive type of work, whereby a lot of, um, design principles have to be used, um, in order to make efficient applications that will be usable for users” (ptp02).*

- The participants found that reading the HCI theory provided a more comprehensive understanding than the tutorial videos provided. *“Yes, it was very beneficial. Just reading through it, it was even more thorough than just um, yeah, what was given in videos” (ptp03).*
- The HCI participants stated that the theory content was enriched with examples, which made reading more advantageous and insightful for them. *“The theory was very thorough. Everything was given with examples, so it was very beneficial to read. And to be able to do the assignment” (ptp03).* *“It was beneficial. This theory is very detailed. Everything was given there with examples, so it was very beneficial to read and to be able to do the assignment” (ptp04).*

The findings revealed that participants found the HCI theory beneficial in their studies. They realised that when they read the theoretical content, they could comprehend HCI in depth and apply it in practical assignments. The next section presents the *challenges experienced* in this category.

8.5.3.6 Challenges experienced category

In this section, participants were asked to list the most significant challenges they faced during the reflective practice process. The participants were also asked to elaborate on their answers. The participants were asked to determine whether they experienced any challenges when they were involved in the reflective practice process. The responses were coded as shown in Table 8.11.

Table 8.11: Summary of the challenges experienced codes

Code No.	Code	Frequency
1.	Being creative	1
2.	Don't recall challenges	1
3.	How to answer a question	1
4.	Reading the question correctly	1
5.	Understand the question	2
6.	Understand the requirements	1

The challenges experienced by the HCI participants can be summarised as follows:

- Participants acknowledged their mistakes and identified potential improvements. *"I took note of what errors I made or what decisions I could have done better" (ptp01).*
- Not all participants encountered difficulties in completing the assignments. *"I don't recall having a, a stiff or a challenge that I can recite" (ptp02).*
- Some participants cited understanding the question as one of the challenges they encountered in completing the assignments. *"I think one of the most challenging things, was trying to understand the questions" (ptp03).* *"I think, uh, making mistakes like not reading questions correctly or not understanding the questions correctly" (ptp04).*
- The participants realised that not understanding the question could lead to an incorrect answer. *"Somehow, I will find myself answering a question incorrectly, but after that, if I, when I give myself some time, like after maybe, uh, the due date of the test, I am, I am going through the same questions, I will realise that I knew the answer to that question, but I could not answer it because I misunderstood the content end of the question at that time" (ptp04).*

In this category, the participants identified the challenges they experienced after receiving feedback and noted that they could perform better. The main challenge they identified was inability to understand the question. The next section presents the **planning first** category.

8.5.3.7 Planning first category

In this section, participants were asked whether they were currently planning before completing any assessment or whether they continued to carry out activities as they used to do previously. They were asked to indicate whether they had planned before completing the work to assist them to carry out their work. The participants were also asked to elaborate on their answers. Responses were coded, as described in Table 8.12.

Table 8.12: Summary of planning first codes

Code No.	Code	Frequency
1.	Plan first	4
2.	Summarise main idea	1
3.	Use HCI principles	2
4.	Use reflective practice	2

The responses of the HCI participants in the ***planning first*** category can be summarised as follows:

- Participants recognised the benefits of pre-planning, especially when assigned to create a project from the ground up. *“I’ve seen the advantages of planning beforehand, especially when tasked with creating a project from scratch” (ptp01).*
- The participants indicated that they had discovered that they relied on the HCI textbook as a guide to complete tasks in other modules. *“Yes, I do plan. Uh, for instance, I find myself, especially like the one that we are doing for Work Integrated Learning, we are doing mobile app referring to like the HCI textbooks and what we are doing, especially on how to place, um, icons or text areas and stuff.” (ptp02).*
- Participants exhibited a higher degree of reflection on their actions and activities. *“My approach has changed in a way that I’m a bit more reflective to what am I doing now” (ptp02).*
- Participants indicated that they now prioritised planning, and deciding whether to use paper or a mind map to outline how they would execute their work. *“The reflective practice has helped a lot, I do plan now. I first have to plan it, whether on paper or just a mind map or something, how I will go about carrying it out” (ptp03).*
- The participants indicated that they had learned from their previous mistakes and now understood the importance of planning. This new knowledge motivated them to engage in the planning process to avoid errors and ensure better outcomes. *“I*

plan because I have learned and have been looking at my mistakes that I have made before, so it's better for me to plan” (ptp04).

The participants noted that they no longer carried out the activities as they used to do before, but they had started planning before starting any work. They learned from their mistakes and realised that if they had planned beforehand, they could have saved time. The next section presents the **reflective practice application** category.

8.5.3.8 Reflective practice application category

In this section, participants were asked how they would apply what they had learned to advance their careers. This question was asked to determine whether participants were going to use the knowledge acquired to further their professional goals. Various responses were provided. These were further coded as presented in Table 8.13.

Table 8.13: Summary of the reflective practice application codes

Code No.	Code	Frequency
1.	Analyse problems	1
2.	Apply HCI theory to design	1
3.	Apply in the job market	1
4.	Plan thoroughly	1
5.	Reflect to improve	1

The responses of the HCI participants in the **reflective practice application** category can be summarised as follows:

- The participants noted the knowledge they had gained from studying the HCI module. *“The subject really gave me an insight into the theoretical aspect of graphical design and human-computer interaction” (ptp01).*
- According to the participants, the HCI module was interesting in terms of looking in greater depth at certain concepts. *“The subject also picked my interest to look more in-depth at certain concepts that went elaborated on the subject. “It definitely sparked something in me to have a keener eye for designing my systems” (ptp01).*

- The participants indicated that they would need HCI skills to become software developers. *“What I’ve learned is, is, is very crucial because I plan to be, uh, a software developer. “As software developers, there is a lot of design that happens, especially for the front-end type of, um, work where we have to design, um, interfaces that meet user specifications in a way that is effective, um, and elegant and easy to use” (ptp02).*
- The participants indicated that learning HCI content assisted them in their approach to the design. *“I think it really has contributed, and also on the approach of how to work with the design” (ptp02).*
- The participants acknowledged that they would use analytic skills to address challenges. *“I think I’ll use the same technique of analysing every problem because, um, it’s an Information Technology (IT) person all you get in life, it’s problem-solving” (ptp03).*
- The participants indicated that they were more aware of their actions as a result of RP. *“I think, um, since it’s part of this reflective practice is also part of a self-awareness” (ptp04).*
- The participants indicated that they would reflect on their mistakes in order to improve. *“I will reflect on the mistakes that I’ve made before to improve my profession” (ptp02).*

The findings revealed that participants could see improvements in their studies when they applied HCI theory content. They were also aware of their actions and able to reflect on their mistakes. The next section presents the ***developing into a reflective practitioner*** category.

8.5.3.9 Developing into a reflective practitioner category

In this section, participants were asked whether they regarded themselves as reflective practitioners. The participants were also asked to elaborate on their responses. Responses are coded accordingly, as shown in Table 8.14.

Table 8.14: Summary of developing into a reflective practitioner codes

Code No.	Code	Frequency
1.	Developed into a reflective practitioner	4
2.	Gather thoughts first	1
3.	Plan first	1
4.	Reflect on work done	1
5.	Self-awareness	1

The responses of the HCI participants in the category about ***developing into a reflective practitioner*** can be summarised as follows:

- Participants affirmed their growth as reflective practitioners. *“I’d say I, I am” (ptp01). Yeah. I believe that everyone would like to be on this side. So, yes, I’d say I am” (ptp02). Yes. Um, I love planning” (ptp03).*
- Participants indicated that they integrated the principles of reflective practice into their work. *“I am following the principles of being a reflective practitioner in my own work” (ptp01). “I reflect on the principles that I make use of, in the design work or whatever work I am doing” (ptp02).*
- Participants indicated that they became aware of the benefits of reflective practice in aiding them to organise their thoughts. *“I noticed the advantages of working with writers, and I’ve seen my workflows improve, especially when working with other people. It helps to catch thoughts before reaching them in” (ptp01).*
- Participants said they engaged in frequent reflections on their actions and decisions. *“I would say I’m a reflective practitioner in that I reflect upon a lot on what I do” “Checking the video of reflective practice, it really helped me to become better at, um, planning before doing something” (ptp03).*
- Participants indicated that RP served as a means of effectively accomplishing tasks. *“It was actually because that’s how I managed to complete my theory. It was a stepping stone for me to achieve my module.” (ptp04).*

The participants stated that they developed as reflective practitioners. They noted that RP assisted them in accomplishing the given tasks. The next section presents the *specify learning phase* to reflect on each category.

8.6 Specify learning phase

After analysing the data collected, the researcher evaluated the outcomes of the intervention to determine whether any progress had been achieved. A reflection is provided for each category, starting with the reflections from *understanding the reflective practice concept* category, proceeding to the *challenges encountered*, and concluding with *developing into a reflective practitioner* category.

8.6.1 Reflections from understanding the reflective practice category

Participants were asked about their understanding of reflective practice. The researcher wanted to determine if the participants viewed the concept of RP as part of lifelong learning to foster continuous learning and self-improvement. *Ptp01* noted that RP is “*looking back at your work*”. He made an example of receiving graded work back. He stated that he reviewed the errors he had made and considered how he could improve in the next assignment. *Ptp02* understood RP as reflecting on the approach and implementation. The response demonstrates that the participants reflected on the planning stage and executed that particular plan. Planning before starting with implementation assists in learning and understanding what one has done. It also gives students a chance to improve their work.

Ptp03 also gave a similar answer to *Ptp01* and *Ptp02*. She described RP as “*Reflecting on what has been taught and the application of that*”. This demonstrates that the participants understood the concept of RP. Understanding the concept in this context demonstrates that the participants can make informed decisions about what to apply in their work. *Ptp04*’s understanding of RP also included prior experience and lifelong learning. She understood RP as “*thinking about your experiences*” and “*making efforts to learn*”. Gaining insights into what you know and allowing yourself to improve are part of self-development. The participant demonstrated that she wanted to grow in her career. Supported guidelines for understanding the RP concept data category are presented in Table 8.15.

Table 8.15: Supported guidelines from understanding of the RP concept data

Data in support	Supported guidelines from Table 7.24
Setting a specific assignment to bridge the theory-practice gap.	
Checking errors and improving for next time	TPG9: Document experiences
Assessment strategy to promote reflection.	
Reflecting on what has been taught and the application thereof	ASG1: Monitoring student's reflection
Reflecting on what you have done	ASG1: Monitoring student's reflection
Looking back at your work	ASG1: Monitoring student's reflection
Thinking back	ASG1: Monitoring student's reflection
Thinking about your experiences	ASG1: Monitoring student's reflection

In this section, all the participants were able to respond to the question regarding their understanding of RP. Their responses indicated that they knew what RP was and how to apply it in their context. However, no related possible actions were expressed to ensure that the students understood the concept of RP. Additional possible actions that emerged from understanding the RP concept category data are presented in Table 8.16.

Table 8.16: Additional possible actions from understanding the reflective practice concept category data

Additional possible interventions	
Possible intervention	Related to the guideline from Table 7.24
EC3AS1: Ensure that students understand what is meant by reflective practice.	ASG4: Reflective practice strategy

The next section presents reflections on the *new plan* category.

8.6.2 Reflections from the new plan

Participants were asked what they would do differently if they were to repeat the HCI module. Different responses were received, such as consulting the lecturer to obtain input. *Ptp01* indicated that he was going to ask what was wrong with the principles he used in his work so that he could improve on applying the correct principles. *Ptp02* also mentioned that he was going to pay more attention to the design principles to guide him in designing the interfaces. *Ptp02* acknowledged the importance of design principles and their role in guiding the process of designing interfaces. The participants realised that by paying closer attention to these principles, they could improve the quality of their interface designs. This demonstrates their willingness to improve their skills and approach to design, demonstrating a proactive and reflective approach to professional growth. *Ptp02* is likely to create more user-friendly and effective interfaces by incorporating design principles into its work, resulting in a more satisfying user experience. Overall, the statement demonstrated dedication to lifelong learning and the desire to put theoretical knowledge into practice in their field. The guidelines supported by the ***new plan*** category data are presented in Table 8.17.

Table 8.17: Supported guidelines from a new plan data

Data in support	Supported guidelines from Table 7.24
Overall instructional design orientation.	
Enjoy the HCI module when enrolled in it.	IDG1: Enhance teaching quality
General advice to students to improve performance.	
Consult the lecturer about work they do not understand.	IPG1: Question-answer session
Rectify mistakes made in the given task.	IPG8: Completing assigned work.
Setting a specific assignment to bridge the theory-practice gap.	
Pay attention to HCI principles when designing applications.	TPG1: HCI principles and goals
Assessment strategy to promote reflection.	
Get feedback on mistakes made.	ASG3: Detailed feedback

Ptp03 indicated that she would be more committed to her studies because she felt that she had not studied enough. Indeed, the participant's statement demonstrated self-awareness and a genuine desire to improve. She recognised that she may not have studied thoroughly enough, which may have resulted in mistakes. By admitting these mistakes, the participant demonstrated a reflective mindset and a desire to correct the situation. The participant's commitment to learning from her mistakes and preventing them from happening again in the future demonstrates a proactive approach to personal and professional development. This self-reflection and commitment to improvement suggests that the participant intends to study more thoroughly and devise strategies to avoid making the same mistakes again. This type of introspection and commitment to learning are essential characteristics of a reflective practitioner who constantly seeks to improve their skills and knowledge. The next section provides reflections on the ***problem-solving ability*** category.

8.6.3 Reflections from problem-solving abilities

Participants were asked whether they could improve their problem-solving abilities as a result of the reflective practice exercise. It was expected that the participants would develop problem-solving skills from the RP exercises they were involved in. All participants affirmed that their problem-solving abilities had improved. According to *ptp01*, RP improved his studies. He reflected on one of the assignments and highlighted the mistake he had made and realised later that he could have improved his work. *Ptp02* mentioned that his work had improved in the previous year. He is currently integrating symmetry into his work. *Ptp03* noted that she used the experience gained from the HCI in another module. She found herself applying HCI principles in her design. She also mentioned that reading the question thoroughly during the second assignment improved her performance. *Ptp04* applied the problem-solving skills gained in the other modules. Therefore, the problem-solving skills of the participants improved after the RP exercises. Guidelines supported by the *problem-solving abilities* category data are presented in Table 8.18.

Table 8.18: Supported guidelines from problem-solving abilities data

Data in support	Supported guidelines from Table 7.24
Guiding reflection by and among students.	
Use experience to solve problems encountered.	RSG2: Prior knowledge
Reflect on improving oneself.	RSG5: Reflective skills
Reflect on different ideas to put in the assignment.	RSG6: Problem-solving skills
Use new approaches to solve the challenges faced.	RSG6: Problem-solving skills
Assessment strategy to promote reflection.	
Use a rubric to check how one's work will be assessed.	ASG2: Evaluation standards
Understand the question before providing the answer.	IPG4: Research and understand the question
Rectifying colour scheme in the application.	IPG8: Completing assigned work.
Identify and rectify mistakes made in the assignment.	IPG8: Completing assigned work.

The next section presents reflections on ***understanding of the question*** category.

8.6.4 Reflections from understanding of the question

Participants were asked about ways in which understanding the questions assisted them during the assessments. According to Nickerson (1985), if a student answers a question incorrectly, it may indicate that he or she does not understand what is being asked. Hence, students must understand what is being asked. *Ptp02* was cautious not to make assumptions about understanding the question, and instead asked questions to ensure clarity. Asking questions in this context was beneficial for the participant to ensure that he understood what was being asked. This is one way to reflect on the question. RP helps ensure that students provide accurate responses. Understanding the question also gives an indication whether students can demonstrate knowledge gained in a particular area of study. Understanding this question also assists in tailoring responses to a specific context. Students can

remain focused on a particular topic in a specific context. The supported guidelines for ***understanding of the question*** category data are presented in Table 8.19.

Table 8.19: Supported guidelines from understanding of the question data

Data in support	Supported guidelines from Table 7.24
Setting a specific assignment to bridge the theory-practice gap.	
Link of theory with practice.	TPG4: Link theory with practice.
General advice to students to improve performance.	
Answer question correctly.	IPG4: Research and understand the question
Gain a better understanding of the work.	IPG4: Research and understand the question
Understand which keywords to look for in the question.	IPG4: Research and understand the question
Reflect on the question to understand what is required.	IPG4: Research and understand the question

Engaging in reflection on the question helped the participants grasp and comprehend what was being asked. *Ptp03* mentioned that this helped her understand what had been asked. She also noticed a difference between the first and second assignments. In the first assignment, the participant did not grasp what was meant by reflection, and in the second, she reflected on what was asked. In the second assignment, she described how she approached the problem holistically, focusing on the main goal rather than on individual questions. The next section provides reflections from the ***application of the theoretical content*** category.

8.6.5 Reflections from the application of the theoretical content

Students were taught HCI theory, which includes HCI principles. The students were expected to incorporate the principles in any practical assignment that involved graphical user interface design. This was part of bridging the perceived gap between

theory and practical work in the HCI classes. Participants noted the benefits of using the HCI theory in their current work. Even though they were no longer in HCI, they continued to apply what they had learned. HCI theory helped to guide them on what to do when designing interfaces. They realised that HCI could be incorporated seamlessly into their work to create efficient interfaces. Interfaces that were usable for users were highlighted by participants during the interview. This means that participants realised the importance of creating applications that address usability issues. RP is a fundamental method for implementing theory in professional practice (Bassot, 2023). The supported guidelines from the application of the theory data are presented in Table 8.20.

Table 8.20: Supported guidelines from the application of theory data

Data in support	Supported guidelines from Table 7.24
Setting a specific assignment to bridge the theory-practice gap.	
Benefits of using the HCI theory	TPG1: HCI principles and goals
Application of theory to practice	TPG4: Linking theory with practice
Using the theoretical content was a stepping stone to pass the module	TPG4: Linking theory with practice
Guiding reflection by and among students.	
RP is part of self-awareness	RSG1: Reflective guidelines
Developing into a lifelong learner	RSG1: Reflective guidelines

Being previously enrolled in the HCI module assisted the participants in studying the theory content even after they passed the module. *Ptp03* mentioned that she found that reading the theory helped because it was clearer than just going through the tutorial videos. She also mentioned that it was beneficial to use theoretical work to complete the practical assignments. Returning to reading the HCI theory to incorporate it in the current work indicates that the participant reflects on what she learned. According to Fuertes-Camacho *et al.* (2021), individuals are encouraged to

engage in critical self-reflection to help them become lifelong learners. This demonstrates that RP is important for participants to advance their practice to improve their actions. Participants also appreciated the examples provided by the HCI theory. They stated that these examples enabled them to complete their assignments. The next section presents reflections on ***the challenges experienced*** in the category.

8.6.6 Reflections from challenges experienced

Participants were asked to state the most significant challenges they faced during the reflective practice process. The researcher expected participants to reflect on the challenges they had experienced to indicate that they had reflected on them. *Ptp01* emphasised that he carefully observed his mistakes and considered how he could have made better decisions. This statement demonstrates openness to self-analysis and learning from his experiences. The participant demonstrated a reflective attitude toward his studies by noting his mistakes and areas for improvement, demonstrating his commitment to personal and professional growth. Reflective practitioners actively improve their performance and decision-making skills through introspection through continuous learning.

One of the most difficult aspects that *Ptp03* and *Ptp04* highlighted was understanding the question. Acknowledging that they did not understand the questions indicates the difficulty they had in understanding the task requirements and objectives. This realisation is valuable because it indicates the recognition of areas that require improvement. Understanding these questions is essential for effective problem-solving and accurate responses. Recognising this challenge demonstrates the participants' reflective mindset and openness to address the issue and develop strategies to improve their comprehension skills. It is important to be aware of one's challenges and to work actively to overcome them as reflective practitioners seeking continuous growth and development. Supported guidelines from the ***challenges experienced*** category data are presented in Table 8.21.

Table 8.21: Supported guidelines from challenges experienced data

Data in support	Supported guidelines from Table 7.24
General advice to students to improve performance.	
Understand the question to complete the assignment.	IPG4: Research and understand the question
Understand the requirements of the assignment.	IPG4: Research and understand the question
Problem with reading the question correctly	IPG4: Research and understand the question
Encountered problems with how to answer a question	IPG4: Research and understand the question
Problem with being creative	IPG10: Enhancing design skills

The next section presents reflections on the *planning first* category.

8.6.7 Reflections from planning first

The participants were asked whether they did any planning before completing an assessment or whether they continued to carry out activities as they used to. The researcher wanted to determine whether the participants realised the advantages of planning before starting an assignment. *Ptp01* indicated that he recognised the benefits of planning, particularly when undertaking projects from the beginning. Planning, in this case, leads to better decision-making. The participants were able to decide what to include in the assignment and filter out irrelevant information.

Having a plan in place also assists in achieving goals. *Ptp03* stated that she now prioritises planning before execution using either paper or a mind map to outline how she will carry out her work. Planning assists in ensuring that work is completed on time. It is an organised approach for dealing with the challenges faced or completing work. *Ptp02* applied the planning skills gained from the RP exercise in his current project. He planned to place icons on the mobile application that he was creating. He mentioned that he had used the HCI textbook for planning. The supported guidelines from the *planning first* category data are presented in Table 8.22.

Table 8.22: Supported guidelines from planning first data

Data in support	Supported guidelines from Table 7.24
Guiding reflection by and among students.	
Use reflective practice to carry out activities.	RSG5: Reflective skills
General advice to students to improve performance.	
Summarise the main idea of the text.	IPG7: Studying after lecture
Setting a specific assignment to bridge the theory-practice gap.	
Use HCI principles in the application designs.	TPG1: HCI Principles and goals
Start by planning first when doing any work.	TPG7: Prototyping

The participants gained valuable insights from their previous mistakes and realised the importance of planning. This new understanding motivates them to actively engage in the planning process, allowing them to avoid errors and achieve better results in their endeavours. *Ptp04* noted that it is better to first plan in order to avoid making mistakes. The next section provides reflections from the **reflective practice application** category.

8.6.8 Reflections from reflective practice application

Participants were asked how they would apply what they had learned to advance their careers. According to Bassot (2023), reflective practice does not replace theory but is rather a way to enhance one's understanding of practice through the use of theory. This means that theory provides a foundation for the knowledge and principles from which practice can be guided. *Ptp01* noted that the module provided him with valuable insights into the theoretical aspects of graphical user interface design and HCI. This corroborates what Bassot (2023) stated about the fact that theory gives insight into practice.

Meeting the needs of users is important in HCI. *Ptp02* stated that he aspires to become a software developer. He stated that software developers, especially those involved in front-end work, engage in extensive design efforts to create interfaces

that are not only effective, but also elegant and user-friendly, meeting the specific needs and preferences of users. This means that systems created by designers should meet the specific needs of the intended users. The designers should further look into the requirements and preferences of their users by gathering data on their preferences. The supported guidelines for RP applications are presented in Table 8.23.

Table 8.23: Supported guidelines from RP application category data

Data in support	Supported guidelines from Table 7.24
Guiding reflection by and among students.	
Application of HCI theory to practical design	TPG1: HCI Principles and goals
Creating systems that meet users' needs and preferences	TPG6: User's role
Overall instructional design orientation.	
The module provided valuable insights into the theoretical aspects.	IDG2: Lecture method
Application of what was learned from HCI theory in the job market	IDG6: Theory-practice gap
Guiding reflection by and among students.	
RP led to more conscious and informed decisions.	RSG3: Critical skills
Gained problem-solving skills by completing the assignment	RSG6: Problem-solving skills

Ptp03 mentioned that she will use the skills of problem-solving because IT is about solving problems. In IT, students are assigned practical assignments. Assignments are often related to social challenges that need to be addressed. From the first-year level, students were required to write a simple program using a specific programming language. In the HCI class, they are taught the principles of design so that they can design user interfaces that are easy for users to navigate. The skill of problem-

solving is a critical skill in IT in general; hence one of the requirements to enrol into the programme is to have a Mathematics module in Grade 12.

Owing to the RP exercises, participants are now conscious and mindful of their actions. As a result of the RP, *ptp04* said she gained awareness of her actions, allowing her to make more conscious and informed decisions. *Ptp02* also mentioned that he would engage in reflection on past mistakes to enhance his professional development. *Ptp01* highlighted that the presence of keywords helped him better comprehend the question. Even though the participant was looking for keywords in the question, it was important to read the entire question and analyse it as a whole. The participant was of the opinion that a holistic view could assist in answering the question correctly, instead of looking at different parts. Table 8.24 presents the emerging possible actions from the RP application category data.

Table 8.24: Additional possible action from RP application category data

Additional possible intervention	
Possible intervention	Supported guidelines from Table 7.24
General advice to students to improve performance.	
C3EPI1: Ask students to consider the whole question holistically to avoid taking a fragmented approach to the question.	IPG1: Question-answer session

Reflections from ***developing into the reflective practitioner*** category are presented in the next section.

8.6.9 Reflections from developing into a reflective practitioner

Participants were asked whether they regarded or viewed themselves as reflective practitioners. The researcher expected the participants, who regarded themselves as reflective practitioners, to demonstrate the aspiration to continuously learn and improve. According to the data, three participants (75%) confirmed that they had developed into reflective practitioners. The other participant only mentioned how

reflection assisted her in accomplishing what she wanted to do. *Ptp01* mentioned that he continued to adhere to the principles of being a reflective practitioner. He affirmed that he reflected on the principles used in his design work. The participants' continued use of design principles learned in the previous year's HCI class demonstrates that they recognised the advantages of applying these principles in their work. It also indicates that the participant reflected on the principles used in his designs.

Ptp02 noted that he observed the benefits of collaborating with writers and noticed significant improvements in his workflows, particularly when working with others. RP helped him to capture his thoughts before they were conveyed to the team members. Reflecting on what the participant was going to discuss assisted him in gathering thoughts beforehand. This means that the participant wanted to make a meaningful contribution to what he does and demonstrated problem-solving abilities. Supported guidelines from the ***developing into a reflective practitioner*** category are presented in Table 8.25.

Table 8.25: Supported guidelines from developing into a reflective practitioner data

Data in support	Supported guidelines from Table 7.24
Guiding reflection by and among students.	
Start by planning first when doing any work.	RSG1: Reflective guidelines
Being self-aware of one's actions	RSG5: Reflective skills
Participants affirmed that they developed into reflective practitioners.	RSG5: Reflective skills
Assessment strategy to promote reflection.	
Reflecting on work done	ASG1: Monitoring student's reflection
Gathering thoughts first before taking any step	ASG4: Reflective practice strategy

Ptp03 mentioned that the RP video assisted her in planning before undertaking any tasks. She also stated that "*I'm a reflective practitioner in that I reflect a lot on what I*

do". Engaging in reflection on what to do can help participants avoid impulsive actions. When *Ptp04* was asked to elaborate, she noted that reflective practice helped her pass the module. Table 8.26 presents the emerging guidelines from data in the ***developing into reflective practitioner*** category.

Table 8.26: Additional possible action from data in the developing into a reflective practitioner category

Additional possible intervention	
Possible intervention	Supported guidelines from Table 7.24
Guiding reflection by and among students.	
EC3RS1: Ask students to engage in reflective practice on a regular basis to improve their reflective skills.	RSG5: Reflective skills

Reflections from the ***specify learning*** phase are discussed in the next section.

8.6.10 Reflections from specify leaning phase

In this section, actual interventions are reviewed to evaluate their effectiveness from the lecturer's point of view. A "yes" indicates successful interventions, a "no" indicates unsuccessful ones, and "not sure" is used when the outcome is unclear. If the intervention was unsuccessful, a brief explanation was provided. A summary of the ***specify learning*** phases is presented Table 8.27.

Table 8.27: Summary of the specify learning phase

Action-taking	Student's success from the Lecturer's perspective	Success in terms of guidelines
Setting a specific assignment to bridge the theory-practice gap.		
C3TP_AI1: Asked participants whether it was beneficial to use theoretical work to complete the practical assignment.	Yes	Yes
C3TP_AI2: Observed from the responses if participants were able to choose relevant content for their practical designs.	Yes	Yes
C3TP_AI3: Asked participants whether they were currently planning before completing any assessment or if they continued to carry out activities as they previously used to do.	Yes	Yes
C3TP_AI4: Asked participants what they would do differently if they were to repeat the HCI module.	Yes	Yes
Guiding reflection by and among students.		
C3RS_AI1: Enquired if the students are still involved in practical work with challenging activities.	Yes	Yes
C3RS_AI1: Asked participants whether they were able to improve their problem-solving abilities as a result of the reflective practice exercise.	Yes	Yes
General advice to students to improve performance.		
C3IP_AI1: Asked participants how understanding the question assisted them during the assessments.	Yes	Yes
C3IP_AI2: Enquired if the participants were following the instructions given to complete the assignment.	Yes	Yes
C3IP_AI3: Determined if the participants were conducting research to gather information for use in their work.	Not sure – the student's responses did not reveal this.	Not sure

Action-taking	Student's success from the Lecturer's perspective	Success in terms of guidelines
C3IP_AI4: Asked participants how understanding the question assisted them during the assessments.	Yes	Yes
C3IP_AI5: Established if the participants were able to manage their time.	Yes	Yes
Assessment strategy to promote reflection.		
C3AS_AI1: Asked participants what their understanding of the concept of reflective practice is.	Yes	Yes
Overall instructional design orientation.		
C3ID_AI1: Asked participants how they would apply what they had learned to advance their careers.	Yes	Yes
C3ID_AI2: Determined if the participants were watching the tutorial videos that were made available to them.	Yes	Yes

Possible interventions that emerged from this third AR cycle are presented Table 8.28.

Table 8.28: Additional possible interventions (Cycle 3)

Additional possible interventions	
Possible intervention	Related to guideline from Table 7.24
EC3AS1: Ensure that students understand what is meant by reflective practice.	ASG4: Reflective practice strategy
EC3RS1: Ask students to engage in reflective practice on a regular basis to improve their reflective skills.	RSG5: Reflective skills

The next section presents the guidelines for this study.

8.7 Guidelines for developing HCI students as reflective practitioners

This section provides the guidelines that were developed for developing HCI students as reflective practitioners and they are presented in Table 8.29.

Table 8.29: Guidelines for developing HCI students as reflective practitioners (Cycle 3)

Guideline Code	Guideline
Setting a specific assignment to bridge the theory-practice gap.	
TPG1: HCI principles and goals	Assist students in using appropriate HCI principles and goals for the current context in their work to analyse, design, evaluate, and implement interactive systems for universal use.
TPG2: User's social context	Encourage students to incorporate reflective practices and consider the perspectives of users and their social context while creating designs and engaging with end users to broaden the scope of their research.
TPG3: External factors	Ask students to evaluate external factors that may affect individuals and practices.
TPG4: Linking theory with practice	Ask students to evaluate what they have learned through practice.
TPG5: Interactive lecture with a case study	Explore different ideas to make activities fun and involve the students in the learning process by assigning a case study based on theory work.
TPG6: User's role	Assist the students in developing a better understanding of the users' role in design.
TPG7: Prototyping	Ask students to develop physical prototyping to gain specific skills.
TPG8: User testing	Ask students to integrate activities such as user testing and those that involve what is done in the industry to enhance designs.
TPG9: Document experiences	Ask students to document successes and challenges that will need to be improved in decision-making and justification for a chosen process.
TPG10: Identifying additional confusing areas	After formative assessments students should be reminded to update their reflection documents to reflect additional learning experiences.
Guiding reflection by and among students.	
RSG1: Reflective guidelines	Provide students with guidance on how to reflect on their studies.

Guideline Code	Guideline
RSG2: Prior knowledge	Provide students with an opportunity to reflect on their experiences in terms of their prior knowledge and knowledge gaps by adding reflection as a key process in their learning cycle.
RSG3: Critical skills	Encourage students to critically examine their own assumptions and those of the methods they chose.
RSG4: Reflective Journal	Encourage students to maintain a reflective journal to become aware of their thoughts, feelings, and reactions to different situations.
RSG5: Reflective skills	Develop specific skills to support various reflection strategies.
RSG6: Problem-solving skills	Develop a set of basic skills in order to suggest possible solutions from various perspectives.
RSG7: Reflecting on learning	Inspire students to add reflection as a key process in their learning cycle.
RSG8: Description of the event	Ask students to reflect on one event by describing their perceptions and not to make any judgments at this stage.
General advice to students to improve performance.	
IPG1: Question-answer session	Establish a platform that encourages students to ask questions about the parts of the work they find challenging.
IPG2: Students bridging the theory-practice gap	Request students to learn theory first to understand the practical component of the module.
IPG3: Time management	Guide students on how to break down abstract tasks to manage their time by providing them with a step-by-step process.
IPG4: Research and understand the question	Request students to seek more information about the topic and understand the question before attempting to answer it.
IPG5: Attending classes	Recommend to students to attend all scheduled theory and practical classes.
IPG6: Preparing for lecture	Ask students to prepare thoroughly for the lecture by reading the relevant section before attending.
IPG7: Studying after lecture	Request students to review the section after each lecture before the next one.
IPG8: Completing assigned work	Advise students to complete all the assigned work.
IPG9: Acquiring correct answers	Ask students to get accurate answers afterwards and try to understand them thoroughly.
IPG10: Enhancing	Encourage students to enhance their design skills by diligently working

Guideline Code	Guideline
design skills	through the examples, exercises, and supplementary practical assignments provided.
Assessment strategy to promote reflection.	
ASG1: Monitoring reflection	Integrate reflection into students' work in a way that makes it possible to monitor that they engage in reflection.
ASG2: Evaluation standards	Develop a rubric to guide the students on how they will be assessed and to facilitate evaluation standards.
ASG3: Detailed feedback	Provide students with detailed feedback quickly to enable them to reflect on their assessed work and to make changes for further action.
ASG4: Reflective practice strategy	Integrate reflective practice as a strategy to assist students in completing the work and to improve their learning.
ASG5: Post-lesson reflection	Provide students with a reflective sheet, allowing them to evaluate the knowledge they have gained during the lesson.
Overall instructional design orientation.	
IDG1: Enhance teaching quality	Reflect on lesson outcomes and acquire a variety of knowledge bases and models for teaching.
IDG2: Lecture method	Teach the theoretical content first for students to understand the practical component of the module, followed by practical classes in a lab.
IDG3: Presentation slides	Use presentation slides to conduct classes and give students an exercise to complete.
IDG4: Persona	Play the role of the persona to represent different user characteristics for the students to understand.
IDG5: Pedagogical concept	Incorporate cross-disciplinary learning environments into classroom teaching and learning.
IDG6: Theory-practice gap	Incorporate practical experience based on theoretical knowledge to develop valuable industry-ready skills.
IDG7: User experience	Emphasise the importance of usability and user experience to students.
IDG8: Maximise students' potential learning	Customise learning by applying different strategies when teaching to accommodate individual needs.
IDG9: Co-teaching	Implement co-teaching to provide more hands-on support to students for their practical work.
IDG10: Evaluate your own teaching	Use feedback from formative evaluation in the classroom to make adjustments for further action.
IDG11: Hybrid classes	Encourage students to attend theory classes online or face-to-face.

Guideline Code	Guideline
IDG12: Online learning environments	Give students the opportunity to learn more effectively by interacting, collaborating, and taking responsibility for their learning through online learning environments.

The limitations of this study are presented in the next section.

8.8 Limitations of the chapter

There was lack of direct contact with participants during the third AR cycle of the study. Participants had completed the HCI module in the previous year. The researcher relied on the third-year lecturers to post the RP recap video for the students to access. The announcement was made alongside the video, providing students with a clear explanation of its content and requesting them to watch it for better understanding.

During the second semester, the researcher requested one of the third-year lecturers to post an announcement to ask the students to participate in the interviews on the said date. The lecturer forgot to send an announcement, and none of the students were available for interviews. Later, an announcement was made, and the participants contacted the researcher to confirm their availability for the interviews.

Due to the student unrest that led to the students boycotting the mid-year examinations, few students were registered for the second semester. The first-semester modules were pre-requisites for second semester module. There were 23 students registered for second semester and only four (4) participants out of six (6) who qualified took part in the AR cycle. The other two (2) students did not come for the interviews. The students who did not come participated in only one of the cycles. The researcher could not determine the reason why they did not participate.

The next section presents the summary of this chapter.

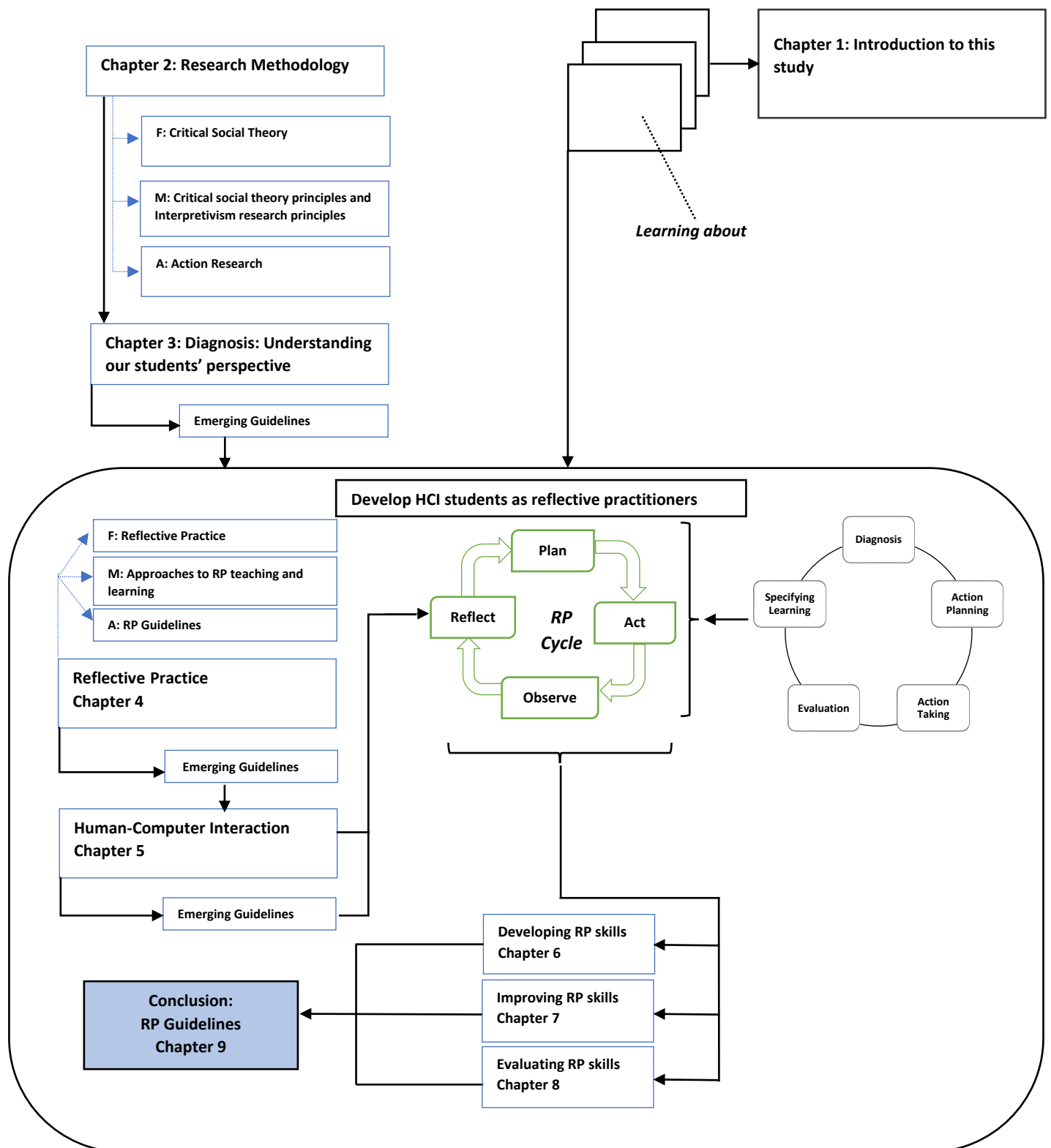
8.9 Chapter summary

The primary objective of this study was to formulate guidelines for developing human-computer interaction (HCI) students as reflective practitioners. In the

diagnosis phase (Section 8.2), the unverified guidelines from AR cycle 2 were presented. The actual interventions from AR cycle 1 and cycle 2 were utilised to develop the intervention plan in Section 8.3. A video-recap about RP was made available for students to view, and interviews were subsequently conducted during the implementation phase which is covered in Section 8.4. Section 8.5 describes how the data was transcribed and analysed, resulting in categories emerging from the participants' data. Conclusions were drawn from the categories, and these were presented in Section 8.5.3. In Section 8.6, reflections were made from each category from Section 8.5.

The results indicated that the guidelines and the interventions developed assisted in developing HCI students as reflective practitioners. The competences of the students enhanced as a result of the interventions.

The guidelines for the study were presented in Section 8.7. This chapter concluded with Section 8.8 in which the limitations of the chapter were presented. The next chapter presents the conclusion of the study.



CHAPTER 9: RESEARCH OUTCOME: REFLECTIVE PRACTICE GUIDELINES

9.1 Introduction

The primary objective of this study was to formulate guidelines for developing human-computer interaction (HCI) students as reflective practitioners. To achieve this, reflective practice (RP) was employed to develop students' reflective skills. This chapter provides an overview of the study. Section 9.2 outlines the key contributions of each chapter in achieving the objectives of the study. The main contributions of the study in terms of guidelines and possible interventions are presented in Section 9.3. Section 9.4 provides an evaluation of the critical and interpretive research. The limitations of this study are discussed in Section 9.5. Future research is presented in Section 9.6. Section 9.7 presents a summary of this study.

9.2 Contributions of each chapter to the study's objectives

This section offers an overview of the respective contributions of each chapter towards achieving the research objectives.

9.2.1 Chapter 1: Introduction to the Study

9.2.1.1 *Primary Objective*

The primary objective of this study was to formulate guidelines to develop human-computer interaction students as reflective practitioners.

9.2.1.2 *Secondary Objectives*

The secondary objectives in terms of the theoretical objectives and empirical objectives for this study are discussed in this section.

9.2.1.3 *Theoretical objectives*

The aim in setting the theoretical objectives for this research was to report on insights regarding the key concepts of this study, including the following:

- To present a justification for the selection of a suitable research approach and to provide a shared understanding of selected research methods in support of the research plan;
- To present a literature review leading to guidelines for the development of RP skills students;
- To present a literature review leading to guidelines for developing HCI skills of students; and
- To consolidate the guidelines for the development of RP and HCI by formulating guidelines that assists in the development of HCI students as reflective practitioners.

9.2.1.4 Empirical objectives

The empirical part of this study was based on a critical research paradigm through action research. The objectives are:

- To present the detail of an initial investigation to improve understanding of the experiences of the participants to guide subsequent AR iterations;
- To conduct an AR investigation after the literature review using the guidelines developed for each AR iteration:
 - *Diagnosing*: To present a reflection on the findings of the previous cycle in terms of student development and guideline development and verification;
 - *Action planning*: To present possible interventions which would develop the RP skills of the HCI students, guided by guidelines, and to verify the practicality of any unverified guidelines;
 - *Action taking*: To present details of the actual interventions in the specific research environment based on the possible interventions, subject to the constraints in the environment;

- *Evaluating* – To present the data collection and analysis of an interpretive investigation aiming to investigate the success of the intervention both in terms of student development and guideline verification;
- *Specifying learning*: To present the findings of the evaluation phase in terms of student development, guideline verification, and development of additional guidelines.
- To present a final set of guidelines to develop HCI students as reflective practitioners.

9.2.2 Chapter 2: Research Methodology

In this chapter, the research methodology chosen to justify the approach used in the study is presented. The critical social theory (CST) research paradigm was selected because it aims to bridge the perceived gap between theory and practice in HCI learning. The purpose of using CST was to instigate transformation in the learning experience of participants and the teaching experience of lecturers of HCI. The lecturer acts as an agent of change, and the goal is to develop HCI students as reflective practitioners.

Action research (AR) was employed to facilitate the study, as shown in Figure 9.1.

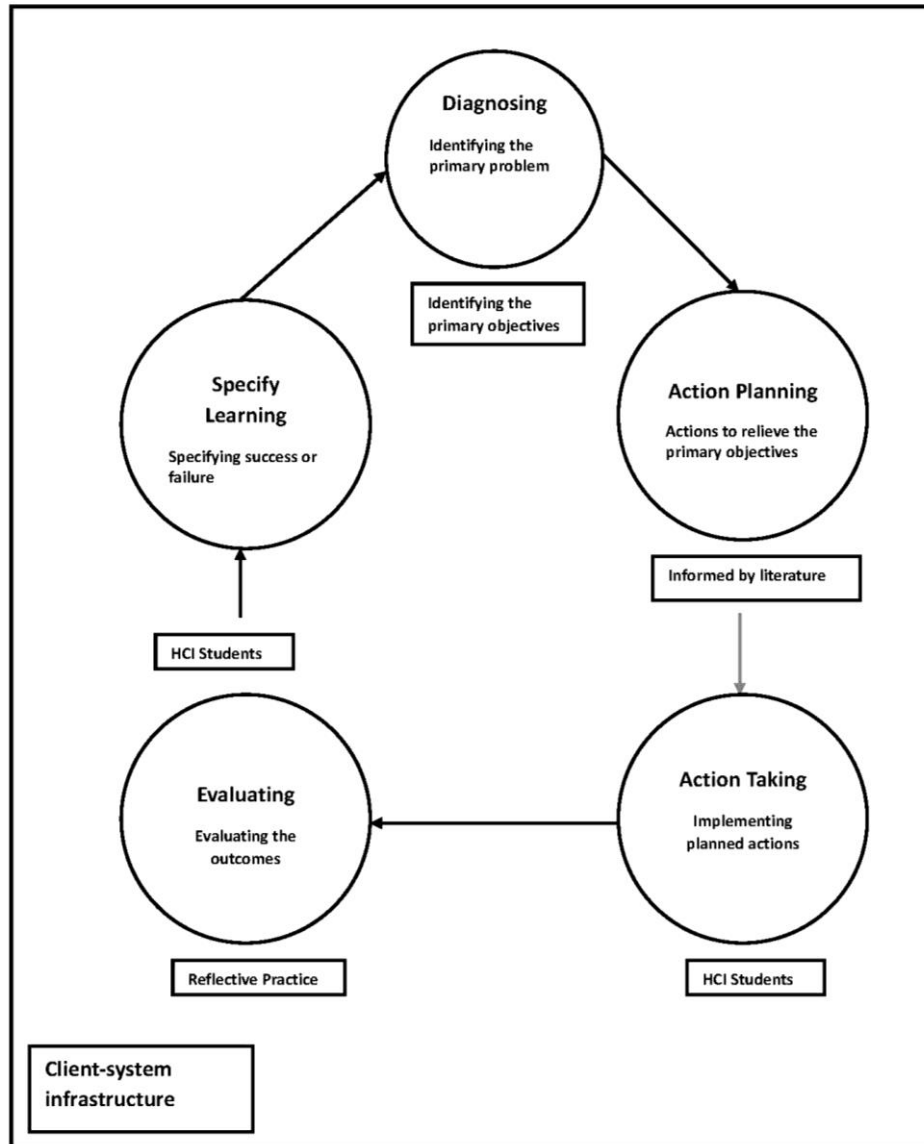


Figure 9.1: The AR cycle for this study based on Baskerville (1999)

9.2.3 Chapter 3: Diagnosis: Understanding our students' perspectives

The initial phase of the action research (AR) cycle was introduced in this chapter with the aim of investigating and identifying the challenging situations that arise in the HCI learning environment. The problem was diagnosed in order to gain an understanding of the students' experiences before selecting an appropriate theory to guide the study. This investigation reflected the perspectives of those affected by the existing instructional design of the HCI module and generated context-specific data to facilitate improvements. Students who volunteered to participate in the study

completed the written interviews after receiving feedback on their assignments. The data collected from the participants resulted in six (6) categories. The categories were: *feedback reaction*, *prior knowledge*, *theory learned*, *theory to practice application*, *preparation*, and *improved answering approach*. The guidelines identified from the diagnosis of the problem are presented in Table 9.1.

Table 9.1: Guidelines for diagnosing the problem (Chapter 3)

Guideline code	Guideline
GDP1: Question-answer session	Establish a platform that encourages students to ask questions about the parts of the work they find challenging.
GDP2: Understand the question	Request students to make sure they understand the question first before attempting to answer it.
GDP3: Research	Ask students to seek more information about the topic to gain more knowledge.
GDP4: Theory-practice gap	Teach theoretical content first for students to understand the practical component of the module.
GDP5: Students bridging theory-practice gap	Request students to learn theory first to understand the practical component of the module.
GDP6: Time management	Assist students with time management strategies
GDP7: Prior knowledge	Incorporate work that will give students a chance to use prior knowledge.
GDP8: Attending classes	Advise students to attend all scheduled theory and practical classes.
GDP9: Preparing for lecture	Ask students to prepare thoroughly for the lecture by reading the relevant section before attending.
GDP10: Studying after lecture	Request students to review the section after each lecture before the next one.
GDP11: Completing assigned work	Advise students to complete all the assigned work.

Guideline code	Guideline
GDP12: Acquiring correct answers	Ask students to get accurate answers afterwards and understand them thoroughly.

The purpose of this chapter was to diagnose the current situation in HCI classes for students to reflect on how they reacted to the feedback received, the prior knowledge they possess, what theory they have learned from the assignment, the perceived theory-practice gap, and the actions they plan to take to tackle similar situations in the future.

9.2.4 Chapter 4: Reflective Practice

The primary objective of this study was to formulate guidelines for developing human-computer interaction (HCI) students as reflective practitioners. Chapter 4 contributes to the realisation of the theoretical objectives of the study. A review of the literature on RP was conducted, following the diagnosis of the problems outlined in Chapter 3. This chapter presents an overview of current research and discussions on the application of RP (F in FMA) as a framework for ideas to develop students as reflective practitioners, as depicted in Figure 9.2.

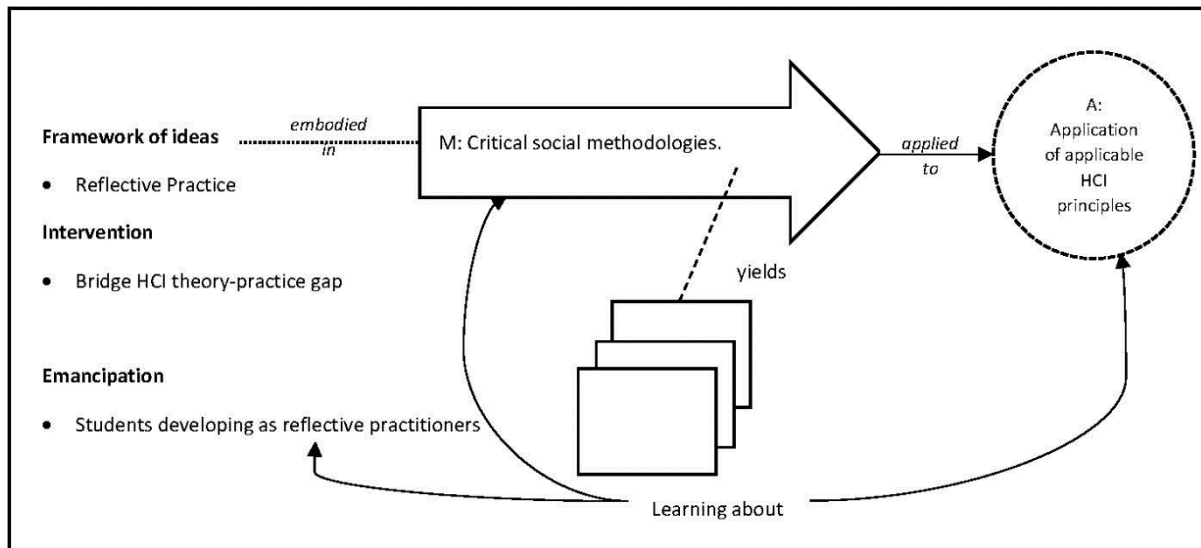


Figure 9.2: Elements of the study depicting Reflective Practice (F)

An overview of the application of the FMA model for RP (F in FMA) in developing HCI students as reflective practitioners was used to gain insights into the main objective of the study. The approaches to reflective teaching and learning are used to represent M in the FMA. Different RP models are discussed, and initial guidelines are formed and subsequently enhanced in ensuing chapters. Different aspects related to RP activities and processes (A) were discussed, and the initial guidelines were formulated. The guidelines that emerged from this chapter are presented in Table 9.2.

Table 9.2: RP guidelines from the literature (Chapter 4)

Guideline code	Related topic	Guideline
RP_G1	Experiential learning	Promote the completion of a new task that will allow the students to construct their knowledge when they apply theoretical content to a specific situation.
RP_G2	Reflective practice strategy	Integrate reflective practice as a strategy to enhance the students' learning process by assisting them to complete the work and improve their learning.
RP_G3	Critical skills	Encourage students to critically examine their own assumptions and those of the methods they chose.

Guideline code	Related topic	Guideline
RP_G4	Description of the event	Ask students to reflect on one event by describing their perceptions and not to make any judgments at this stage.
RP_G5	Decision making	Promote effective decision-making and justification for a specific process.
RP_G6	Reflecting on the process	Document what went well, and the challenges experienced that will need to be addressed in decision-making processes.
RP_G7	Monitoring reflection	Integrate reflection into students' work in a way that makes it possible to monitor that they engage in reflection.
RP_G8	Detailed feedback	Provide students with detailed feedback quickly to enable them to reflect on their assessed work and to make changes for further action.
RP_G9	Reflective guidelines	Provide students with guidance on how to reflect on their studies.
RP_G10	Linking theory with practice	Ask students to evaluate what they have learned through practice.
RP_G11	Prior knowledge	Assist students in reflecting on their experiences in terms of their prior knowledge and knowledge gaps by adding reflection as a key process in their learning cycle.
RP_G12	External factors	Consider factors that influence individuals and practices outside of the practice domain.
RP_G13	Evaluation standards	Develop a rubric to guide the students on how they will be assessed and to facilitate evaluation standards.
RP_G14	Maximise students' potential learning	Customise learning by applying different strategies when teaching to accommodate individual needs.
RP_G15	Reflective journal	Encourage students to maintain a reflective journal to become aware of their thoughts, feelings, and reactions to different situations.
RP_G16	Evaluate	Use feedback from formative evaluation in the classroom to make

Guideline code	Related topic	Guideline
	your own teaching	adjustments for further action.
RP_G17	Enhance teaching quality	Reflect on lesson outcomes and acquire a variety of knowledge bases and models for teaching.
RP_G18	Reflective skills	Develop specific skills to support various reflection strategies.
RP_G19	Problem-solving skills	Develop a set of basic skills in order to suggest possible solutions from various perspectives.
RP_G20	Reflecting on learning	Inspire students to add reflection as a key process in their learning cycle.

Guidelines derived from the literature were used to guide AR cycles.

9.2.5 Chapter 5: Human-Computer Interaction

The main objective of this study was to formulate guidelines for developing human-computer interaction (HCI) students as reflective practitioners. In order to accomplish this, HCI as a framework of ideas (F in FMA) was employed to achieve the outcome of developing HCI students as reflective practitioners. The FMA model for HCI is shown in Figure 9.3.

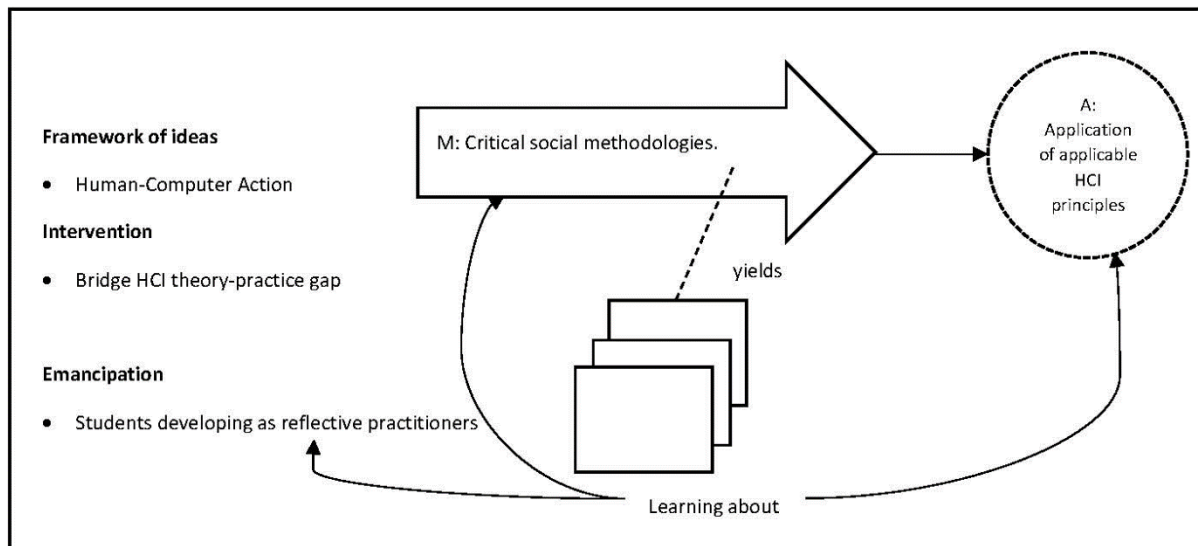


Figure 9.3: Elements of the study depicting HCI (F)

This chapter aimed to gain a better understanding of the current knowledge and discussions on the topic of HCI by reviewing the literature available on these issues. The history of HCI was presented to provide background to the subject. HCI in academia was then discussed, and the fields that contributed to the HCI field were also presented. Based on the literature review, several guidelines were identified, as presented in Table 9.3.

Table 9.3: HCI guidelines from the literature (Chapter 5)

Guideline code	Related topic	Guideline
HCI_G1	Theory-practice gap	Incorporate practical experience based on theoretical knowledge to develop valuable industry-ready skills.
HCI_G2	User testing	Ask students to integrate activities such as user testing and those that involve what is done in the industry to enhance designs.
HCI_G3	Conducting HCI classes	Conduct theoretical classes first, followed by practical classes in a lab.
HCI_G4	User's social context	Encourage students to incorporate reflective practices and consider the perspectives of users and their social context while creating designs and engaging with end users to broaden the scope of their research.

Guideline code	Related topic	Guideline
HCI_G5	User's role	Assist the students in developing a better understanding of the users' role in design.
HCI_G6	User experience	Emphasise the importance of usability and user experience to students.
HCI_G7	HCI principles and goals	Assist students in using appropriate HCI principles and goals for the current context in their work to analyse, design, evaluate, and implement interactive systems for universal use.
HCI_G8	Interactive lecture	Explore different ideas to make activities fun and involve the students in the learning process by assigning a case study based on theory work.
HCI_G9	Presentation slides	Use presentation slides to conduct classes and give students an exercise to complete.
HCI_G10	Pedagogical concept	Incorporate cross-disciplinary learning environments into classroom teaching and learning.
HCI_G11	Hybrid classes	Encourage students to attend theory classes online or face-to-face.
HCI_G12	Online learning environments	Encourage students to learn more effectively by interacting, collaborating, and taking responsibility for their learning through online learning environments.
HCI_G13	Time management	Guide students on how to break down abstract tasks to manage their time.
HCI_G14	Co-teaching	Implement co-teaching to provide more hands-on support to students for their practical work.
HCI_G15	Personas	Play the role of the persona for the students to understand.
HCI_G16	Prototyping	Promote the practice of developing physical prototyping among students to gain a specific set of skills.

The guidelines were merged with those from Chapters 3 and 4 and were used in the AR cycles. The first AR cycle is presented below.

9.2.6 Chapter 6: Cycle 1: Developing reflective practice skills

Chapter 6 introduced the first AR cycle, with the aim of developing reflection skills among students. Table 9.4 gives an overview of the first AR cycle.

Table 9.4: Overview of AR Cycle 1

Cycle 1: Developing reflective practice skills			
Overall purpose			
How can I enable students to critically examine their experiences and thoughts to enhance RP skills?			
AR Phase	Examine	Students	Guidelines
Diagnosis phase	What is wrong? What are we trying to fix?	Students face the challenge of applying theoretical knowledge to real-life situations and practical contexts.	Created guidelines from the diagnosis chapter and on literature from RP and HCI.
Action planning phase	What can I do? What possible actions can I take?	Give students a banner to design for the HCI module to be used on their LMS. The banner should reflect what the module is all about. Plan an intervention talk. Plan RP questions to ask the students on a reflective sheet.	Made specific plans to verify the guidelines. Each guideline is associated with a possible action.
Action-taking phase	What can I do? What possible actions can I take?	Held an intervention session to guide students on how to connect theoretical concepts with practical applications. Gave students an assignment to design a banner for the Graphic Design module to be used in the LMS. Asked the students to specify the goals of HCI that they intended to apply to their work and the reasons thereof in an effort to bridge the theory-practice gap. Requested students to complete reflective sheets that required them to reflect on their experiences with the assignment they had submitted to enhance their reflective skills.	Identified guidelines to be tested in the assignment. Specified actions were taken to verify the guidelines.
Evaluation	Which actions	Conducted qualitative data analysis on	Connect the findings of

Cycle 1: Developing reflective practice skills			
phase	did work?	reflective sheets. Data were analysed using conventional content analysis to gain an overall understanding of the situation and to determine if students were able to link theory with practice.	the empirical study to the guidelines. From the set of guidelines, the guidelines were verified, and some were enriched.
Specifying learning phase	What did I learn for the future?	The students did not make the connection yet, and they struggled to understand what they should do. Students did not understand the terminology in the assignment. Some students used any information they thought was relevant from the Internet. Specified learning in terms of the efficiency of guidelines to develop RP skills.	Specified learning in terms of the efficiency of guidelines to develop RP skills. The researcher's reflection is provided to link theory and practice.

In this cycle, the guidelines from Chapters 3, 4, and 5 were merged. The guidelines developed for the study were grouped into five categories: setting a specific assignment to bridge the theory-practice gap; guiding reflection by and among students; general advice to students to improve performance; assessment strategy to promote reflection; and overall instructional design orientation. The guidelines are presented in Table 9.5.

Table 9.5: Guidelines for developing HCI students as reflective practitioners (Cycle 1)

Guideline Code	Guideline
Setting a specific assignment to bridge the theory-practice gap.	
TPG1: HCI principles and goals	Assist students in using appropriate HCI principles and goals for the current context in their work to analyse, design, evaluate, and implement interactive systems for universal use.
TPG2: User's social context	Encourage students to incorporate reflective practices and consider the perspectives of users and their social context while creating designs and engaging with end users to broaden the scope of their research.
TPG3: External factors	Ask students to evaluate external factors that may affect individuals and practices.
TPG4: Linking theory with practice	Ask students to evaluate what they have learned through practice.
TPG5: Interactive lecture with a case study	Explore different ideas to make activities fun and involve the students in the learning process by assigning a case study based on theory work.
TPG6: User's role	Assist the students in developing a better understanding of the users' role in design.
TPG7: Prototyping	Ask students to develop physical prototyping to gain specific skills.
TPG8: User testing	Ask students to integrate activities such as user testing and those that involve what is done in the industry to enhance designs.
TPG9: Document experiences	Ask students to document successes and challenges that will need to be improved in decision-making and justification for a chosen process.
Guiding reflection by and among students.	
RSG1: Reflective guidelines	Provide students with guidance on how to reflect on their studies.
RSG2: Prior knowledge	Provide students with an opportunity to reflect on their experiences in terms of their prior knowledge and knowledge gaps by adding reflection as a key process in their learning cycle.
RSG3: Critical skills	Encourage students to critically examine their own assumptions and those of the methods they chose.
RSG4: Reflective Journal	Encourage students to maintain a reflective journal to become aware of their thoughts, feelings, and reactions to different situations.

Guideline Code	Guideline
RSG5: Reflective skills	Develop specific skills to support various reflection strategies.
RSG6: Problem-solving skills	Develop a set of basic skills in order to suggest possible solutions from various perspectives.
RSG7: Reflecting on learning	Inspire students to add reflection as a key process in their learning cycle.
RSG8: Description of the event	Ask students to reflect on one event by describing their perceptions and not to make any judgments at this stage.
General advice to students to improve performance.	
IPG1: Question-answer session	Establish a platform that encourages students to ask questions about the parts of the work they find challenging.
IPG2: Students bridging the theory-practice gap	Request students to learn theory first to understand the practical component of the module.
IPG3: Time management	Guide students on how to break down abstract tasks to manage their time by providing them with a step-by-step process.
IPG4: Research and understand the question	Request students to seek more information about the topic and understand the question before attempting to answer it.
IPG5: Attending classes	Recommend to students to attend all scheduled theory and practical classes.
IPG6: Preparing for lecture	Ask students to prepare thoroughly for the lecture by reading the relevant section before attending.
IPG7: Studying after lecture	Request students to review the section after the lecture before the next one.
IPG8: Completing assigned work.	Advise students to complete all the assigned work.
IPG9: Acquiring correct answers	Ask students to get accurate answers afterwards to ensure a thorough understanding.
Assessment strategy to promote reflection.	
ASG1: Monitoring reflection	Integrate reflection into students' work in a way that makes it possible to monitor that they engage in reflection.
ASG2: Evaluation standards	Develop a rubric to guide the students on how they will be assessed and to facilitate evaluation standards.

Guideline Code	Guideline
ASG3: Detailed feedback	Provide students with detailed feedback quickly to enable them to reflect on their assessed work and to make changes for further action.
ASG4: Reflective practice strategy	Integrate reflective practice as a strategy into students' learning to assist them in completing the work and to improve their learning.
Overall instructional design orientation.	
IDG1: Enhance teaching quality	Reflect on lesson outcomes and acquire a variety of knowledge bases and models for teaching.
IDG2: Lecture method	Teach theoretical content first for students to understand the practical component of the module, followed by practical classes in a lab.
IDG3: Presentation slides	Use presentation slides to conduct classes and give students an exercise to complete.
IDG4: Persona	Play the role of the persona to represent different user characteristics for the students to understand.
IDG5: Pedagogical concept	Incorporate cross-disciplinary learning into classroom teaching and learning.
IDG6: Theory-practice gap	Incorporate practical experience based on theoretical knowledge to develop valuable industry-ready skills.
IDG7: User experience	Emphasise the importance of usability and user experience to students.
IDG8: Maximise students' potential learning	Customise learning by applying different strategies when teaching, to accommodate individual needs.
IDG9: Co-teaching	Implement co-teaching to provide more hands-on support to students for their practical work.
IDG10: Evaluate your own teaching	Use feedback from formative evaluation in the classroom to make adjustments for further action.
IDG11: Hybrid classes	Encourage students to attend theory classes online or face-to-face.
IDG12: Online learning environments	Allow students to learn more effectively by interacting, collaborating, and taking responsibility for their learning through online learning environments.

Data were collected from participants, and six (6) categories were identified. The categories are *challenging parts*, *problem-solving*, *related theory content used*,

practicality of the theoretical content, lessons learned, and new strategy. Each category was reflected on. The guidelines emerged based on data gathered from the participants, as shown in Table 9.6.

Table 9.6: Emerging guidelines (Cycle 1)

Guideline Code	Guideline
Setting a specific assignment to bridge the theory-practice gap.	
TPG10: Identifying additional confusing areas	After formative assessments, students should be reminded to update their reflection documents to reflect additional learning experiences.
Assessment strategy to promote reflection.	
ASG5: Post-lesson reflection	Provide students with a reflective sheet, allowing them to evaluate the knowledge they have gained during the lesson.

Guidelines were used to develop an action plan and actual interventions. The guidelines were verified at the end of the first AR cycle. The guidelines that were verified and required further action and those that were not verified were used as the inputs in the second AR cycle. The second AR cycle is described in the following section.

9.2.7 Chapter 7: Cycle 2: Improving reflective practice skills

Chapter 7 presented the second AR cycle, with the aim of improving students' reflective practice skills. HCI students were guided through the second AR cycle to develop as reflective practitioners. Table 9.7 gives an overview of the second AR cycle.

Table 9.7: Overview of AR Cycle 2

Cycle 2: Improving reflective practice skills			
Overall purpose: 1. What are some ways I can incorporate reflection activities into my lessons, assignments, and projects? 2. In what ways can I help my students reflect on their learning experiences, challenges, and insights?			
AR Phase	Examine	Students	Guidelines
Diagnosis phase	What is wrong? What are we trying to fix?	Students struggle to grasp the steps necessary to connect theoretical concepts with hands-on work.	Diagnose the problem from Cycle 1.
Action planning phase	What can I do? What possible actions can I take?	Give students a website to design for promoting a specific business. Plan an intervention talk. Plan RP questions to ask the students on a reflective sheet.	The aim of planning is to verify the guidelines that were not verified in the previous cycle. Make specific plans to verify the guidelines.
Action-taking phase	What can I do? What possible actions can I take?	Held an intervention session to guide students on how to connect theoretical concepts with practical applications. Gave students an assignment to design a website to promote a specific business. Provided students with design considerations to consider when creating the website. Requested students to complete reflective sheets that required them to reflect on the assignment while they were completing it to enhance their reflective skills.	Identify which guidelines will be tested in the assignment.
Evaluation phase	Which actions did work?	Conducted qualitative data analysis on reflective sheets. Data were analysed using conventional content analysis to gain an overall understanding of the situation and to determine if students were able to link theory with practice.	Connect the findings of the empirical study to the guidelines. Researcher's reflection: I am linking the theory and the practice
Specifying learning phase	What did I learn for the	The findings revealed that there is an improvement in students' reflection. I need to	From the set of guidelines, the other

Cycle 2: Improving reflective practice skills			
	future?	understand whether they are reflecting because they were asked to, or do they apply reflection in other areas of their life in Cycle 3. Specified learning in terms of the efficiency of guidelines to develop RP skills.	guidelines were verified and extended, while others were not verified.

Data were collected from participants and seven (7) categories were identified. The categories are *the assignment completion plan, assignment completion timeframe, applied theoretical content, challenging activities, solving challenging activities, knowledge application, and resources required*. The AR cycle concluded with the specifying learning phase by reflecting on each category. The focus of the second AR cycle was to improve the students' RP skills and derive insights related to the guidelines for developing HCI students as reflective practitioners. The guideline that emerged from this data analysis cycle is presented in Table 9.8.

Table 9.8: Emerging guideline (Cycle 2)

Guideline Code	Guideline
General advice to students to improve performance.	
IPG10: Enhancing design skills	Encourage students to enhance their design skills by diligently working through the examples, exercises, and supplementary practical assignments provided.

The guidelines were verified, and for those that were not verified, a brief explanation of why they were not verified was provided in Table 7.24.

9.2.8 Chapter 8: Cycle 3: Evaluating reflective practice skills

Chapter 8 presented the third action research cycle, with the aim of evaluating students' reflective practice skills. Table 9.9 gives an overview of the third AR cycle.

Table 9.9: Overview of Cycle 3

Cycle 3: Evaluating reflective practice skills			
Overall purpose: - How does reflection enhance learning outcomes? - Assess a student's ability to integrate theoretical knowledge with practical experience. - Conduct interviews to gauge students' perceptions of their own reflective skills and their perceived growth.			
AR Phase	Examine	Students	Guidelines
Diagnosis phase	What is wrong? What are we trying to fix?	Evaluate whether students have continued reflecting on their work, regardless of their enrolment status in the HCI module.	Check which guidelines were unverified and which ones require further action.
Action planning phase	What can I do? What possible actions can I take?	Outline the key points to cover in a video summarising the concept of reflective practice.	Prepare practical questions related to the actions taken during the first and second cycles to determine whether the students were developing into reflective practitioners.
Action-taking phase	What can I do? What possible actions can I take?	Produce a video that summarises the concept of reflective practice. Ask participants a series of questions in an interview to determine if they are developing as reflective practitioners.	Ask practical questions related to actions taken in previous cycles.
Evaluation phase	Which actions did work?	Interviews were conducted. Data was transcribed. Data were analysed using conventional content analysis to assess the reflective practice skills of the students.	Assess the appropriateness of the guidelines.
Specifying learning phase	What did I learn for the future?	Verify if students still engage in self-reflection on their work, even when they were not enrolled in the HCI module. Specify recommendations for the future.	Evaluate the suitability of the guidelines for developing HCI students as reflective practice.

Actual interventions from the first and second AR cycles were used to formulate the actions for this cycle. A video was created to remind the students about the RP exercises completed. Later, interviews were conducted, and the data collected from the participants were transcribed. Nine (9) categories were identified; namely *understanding the reflective practice concept, new plan, problem-solving abilities, understanding of the question, application of the theoretical content, challenges experienced, planning first, reflective practice application, and developing into a reflective practitioner*. The data revealed that the students were applying the reflective skills to their work and therefore, emancipation took place because of the intervention.

The next section presents the contributions of the study in the form of guidelines and possible interventions to implement the guidelines.

9.3 Developing the students' reflective skills

This section provides the main contribution of this thesis to the primary objective. The primary objective of this study was to formulate guidelines for developing HCI students into reflective practitioners. The study resulted in the provision of guidelines for developing HCI students as reflective practitioners. The final guidelines are listed in Table 9.10.

Table 9.10: Guidelines for developing HCI students as reflective practitioners

Guideline Code	Guideline
Setting a specific assignment to bridge the theory-practice gap.	
TPG1: HCI principles and goals	Assist students in using appropriate HCI principles and goals for the current context in their work to analyse, design, evaluate, and implement interactive systems for universal use.
TPG2: User's social context	Encourage students to incorporate reflective practices and consider the perspectives of users and their social context while creating designs and engaging with end users to broaden the scope of their research.
TPG3: External factors	Ask students to evaluate external factors that may affect individuals and practices.
TPG4: Linking theory	Ask students to evaluate what they have learned through practice.

Guideline Code	Guideline
with practice	
TPG5: Interactive lecture with a case study	Explore different ideas to make activities fun and involve the students in the learning process by assigning a case study based on theory work.
TPG6: User's role	Assist the students in developing a better understanding of the users' role in design.
TPG7: Prototyping	Ask students to develop physical prototyping to gain specific skills.
TPG8: User testing	Ask students to integrate activities such as user testing and those that involve what is done in the industry to enhance designs.
TPG9: Document experiences	Ask students to document successes and challenges that will need to be improved in decision-making and justification for a chosen process.
TPG10: Identifying additional confusing areas	After formative assessments, students should be reminded to update their reflection documents to reflect additional learning experiences.
Guiding reflection by and among students.	
RSG1: Reflective guidelines	Provide students with guidance on how to reflect on their studies.
RSG2: Prior knowledge	Provide students with an opportunity to reflect on their experiences in terms of their prior knowledge and knowledge gaps by adding reflection as a key process in their learning cycle.
RSG3: Critical skills	Encourage students to critically examine their own assumptions and those of the methods they chose.
RSG4: Reflective Journal	Encourage students to maintain a reflective journal to become aware of their thoughts, feelings, and reactions to different situations.
RSG5: Reflective skills	Develop specific skills to support various reflection strategies.
RSG6: Problem-solving skills	Develop a set of basic skills in order to suggest possible solutions from various perspectives.
RSG7: Reflecting on learning	Inspire students to add reflection as a key process in their learning cycle.
RSG8: Description of the event	Ask students to reflect on one event by describing their perceptions and not to make any judgments at this stage.

Guideline Code	Guideline
General advice to students to improve performance.	
IPG1: Question-answer session	Establish a platform that encourages students to ask questions about the parts of the work they find challenging.
IPG2: Students bridging the theory-practice gap	Request students to learn theory first to understand the practical component of the module.
IPG3: Time management	Guide students on how to break down abstract tasks to manage their time by providing them with a step-by-step process.
IPG4: Research and understand the question	Request students to seek more information about the topic and understand the question before attempting to answer it.
IPG5: Attending classes	Recommend to students to attend all scheduled theory and practical classes.
IPG6: Preparing for lecture	Ask students to prepare thoroughly for the lecture by reading the relevant section before attending.
IPG7: Studying after lecture	Request students to review the section after the lecture before the next one.
IPG8: Completing assigned work	Advise students to complete all the assigned work.
IPG9: Acquiring correct answers	Ask students to get accurate answers afterwards and have a thorough understanding of them.
IPG10: Enhancing design skills	Encourage students to enhance their design skills by diligently working through the provided examples, exercises, and supplementary practical assignments.
Assessment strategy to promote reflection.	
ASG1: Monitoring reflection	Integrate reflection into students' work in a way that makes it possible to monitor that they engage in reflection.
ASG2: Evaluation standards	Develop a rubric to guide the students on how they will be assessed and to facilitate evaluation standards.
ASG3: Detailed feedback	Provide students with detailed feedback quickly to enable them to reflect on their assessed work and to make changes for further action.
ASG4: Reflective	Integrate reflective practice as a strategy to assist students in completing

Guideline Code	Guideline
practice strategy	the work and to improve their learning.
ASG5: Post-lesson reflection	Provide students with a reflective sheet, allowing them to evaluate the knowledge they have gained during the lesson.
Overall instructional design orientation.	
IDG1: Enhance teaching quality	Reflect on lesson outcomes and acquire a variety of knowledge bases and models for teaching.
IDG2: Lecture method	Teach the theoretical content first for students to understand the practical component of the module, followed by practical classes in a lab.
IDG3: Presentation slides	Use presentation slides to conduct classes and give students an exercise to complete.
IDG4: Persona	Play the role of the persona to represent different user characteristics for the students to understand.
IDG5: Pedagogical concept	Incorporate cross-disciplinary learning environments into classroom teaching and learning.
IDG6: Theory-practice gap	Incorporate practical experience based on theoretical knowledge to develop valuable industry-ready skills.
IDG7: User experience	Emphasise the importance of usability and user experience to students.
IDG8: Maximise students' potential learning	Customise learning by applying different strategies when teaching to accommodate individual needs.
IDG9: Co-teaching	Implement co-teaching to provide more hands-on support to students for their practical work.
IDG10: Evaluate your own teaching	Use feedback from formative evaluation in the classroom to make adjustments for further action.
IDG11: Hybrid classes	Encourage students to attend theory classes online or face-to-face.
IDG12: Online learning environments	Give students the opportunity to learn more effectively by interacting, collaborating, and taking responsibility for their learning through online learning environments.

The guidelines resulted in interventions that could be implemented to achieve the purpose of the study. The possible interventions for the first and second AR cycles are presented in Table 9.11.

Table 9.11: Possible interventions (Cycle 1 and Cycle 2)

Possible interventions for Cycle 1 and Cycle 2	Linked to guideline
Setting a specific assignment to bridge the theory-practice gap.	
TP_PI1: Demonstrate to students how to incorporate principles into their work by providing examples.	TPG1: HCI Principles and goals
TP_PI2: Design the practical task to prompt students to use the theoretical and design principles they have learned.	
TP_PI3: In the assignment, ask students to identify the principles they have used for their design.	
TP_PI4: Request the students to indicate the importance and benefits of incorporating the users of the system in their design.	TPG2: User's social context
TP_PI5: In the assignment, ask questions to help students think like users and understand user behaviour.	
TP_PI6: Ensure that the students understand the user environment.	
TP_PI7: Ask students to identify the intended users and test the system with them.	
TP_PI8: Ask students to consider cultural, economic, political, and social circumstances that can influence users in their practice.	TPG3: External factors
TP_PI9: Ask students how they applied theory to practical aspects of the assignment.	TPG4: Linking theory with practice
TP_PI10: Ask students to link theoretical content with practice by having them identify the theoretical content needed to complete practical work and incorporate reflection into their learning.	
TP_PI11: Engage students during the lecture and get feedback using online tools.	TPG5: Interactive lecture with a case study
TP_PI12: Use the feedback to refine the next interactive lecture.	
TP_PI13: Provide students with a case study to apply what they have learned.	
TP_PI14: Have students create user profiles using different types of users and	TPG6: User's role

Possible interventions for Cycle 1 and Cycle 2	Linked to guideline
explain how they intend to meet their needs.	
TP_PI15: Ask students to brainstorm ideas by using different techniques to create a prototype.	TPG7: Prototyping
TP_PI16: Request students to develop a prototype that represents the actual system.	
TP_PI17: Ask students to allow users to interact with and test the feasibility of the prototype they have developed.	
TP_PI18: Ensure that students use prototypes to gain feedback from users early in the design process.	
TP_PI19: Ask students to refine and iterate until their prototype is final and ready for submission.	
TP_PI20: Recommend that the students should plan their designs first, to serve as a guide throughout the process.	
TP_PI21: Ask students to get user feedback on the usability of their prototypes by testing with the intended users.	TPG8: User testing
TP_PI22: Assign a reflective sheet or questionnaire to students, including questions about the difficulties they experienced while completing the assignment, how they solved those difficulties, and how they would improve their work if they had additional time.	TPG9: Document experiences
TP_PI23: Use a reflective sheet or questionnaire to ask students to draw conclusions from their experiences and evaluate their decisions to reflect on the choices they have made.	
TP_PI24: Ask students to identify areas that are still confusing to them.	TPG10: Identifying additional confusing areas
Guiding reflection by and among students.	
RS_PI1: Use a reflective sheet or questionnaire to ask students to identify areas for improvement after providing detailed feedback on their assessed work.	RSG1: Reflective guidelines
RS_PI2: Use a reflective sheet or questionnaire to get students be involved in a process of self-inquiry to make connections about what they have learned in theory to apply in practice.	

Possible interventions for Cycle 1 and Cycle 2	Linked to guideline
RS_PI3: After reflecting, ask the students to formulate and write a plan on how they are going to apply what they have learned.	
RS_PI4: Establish realistic learning goals with your students and ask them to reflect on their progress on a regular base.	
RS_PI5: Give students a reflective sheet to incorporate reflection into their learning cycle to assess their prior knowledge and identify knowledge gaps.	RSG2: Prior knowledge
RS_PI6: Ask students to examine how the new information fits in with what they already know.	
RS_PI7: Create a scenario where students can practice making decisions.	RSG3: Critical skills
RS_PI8: Give an assignment that will require students to identify a problem and propose a solution.	
RS_PI9: Organise group discussions for students to demonstrate their ability to construct knowledge.	
RS_PI10: Encourage students to keep journals or portfolios in which they can reflect on their challenges and learning experiences for personal development.	RSG4: Reflective Journal
RS_PI11: Provide students with guided reflection questions on a reflective sheet.	RSG5: Reflective skills
RS_PI12: Ask students to observe their thoughts to improve their work.	
RS_PI13: Remind students that reflection is an ongoing process.	
RS_PI14: Ask students to brainstorm possible solutions to their problems.	RSG6: Problem-solving skills
RS_PI15: Having generated many possible solutions, ask students to evaluate the advantages and disadvantages of each.	
RS_PI16: Ask students how they are going to apply what they learned in real-life situations.	RSG7: Reflecting on learning
RS_PI17: Ask students to create a strategy for how they will adjust their learning based on their understanding and challenges.	
RS_PI18: Ask the students to reflect on their first impressions of the assignment and share them with the instructor.	ASG2: Description of the event
General advice to students to improve performance.	

Possible interventions for Cycle 1 and Cycle 2	Linked to guideline
IP_PI1: During the lesson, ask students to identify areas they do not understand and ask questions about them.	IPG1: Question-answer session
IP_PI2: Set up a separate time for students to consult the Lecturer outside normal class time.	
IP_PI3: Ask students to address practical challenges they observe in the community they live in by applying what they have learned in the HCI module.	IPG2: Students bridging the theory-practice gap
IP_PI4: Ask students to examine theoretical content they have learned previously so they can apply it to their practical assignments.	
IP_PI5: Expect the students to have a barrier against first-time activities.	
IP_PI6: Request students to utilise the schedule in the study guide as a model for managing their time efficiently.	IPG3: Time management
IP_PI7: Provide a timeline of when tasks should be completed and set time frames.	
IP_PI8: Instruct students on how to identify objectives and divide the task into smaller, more achievable sections.	
IP_PI9: Ask students to structure how they are planning to complete the tasks.	
IP_PI10: Emphasise the importance of starting the task on time to minimise distractions and procrastination.	
IP_PI11: Ask students to familiarise themselves with the question by reading it several times before attempting to answer it.	IPG4: Research and understand the question
IP_PI12: Develop the students' research skills by giving them work that will require researched information.	
IP_PI13: Ask students to use reputable sources when conducting research on the Internet.	
IP_PI14: Ensure that the students understand what is meant by the terminology in terms of the artefact.	
IP_PI15: Provide the students with general advice on how to start a project.	
IP_PI16: For each question, ask the students to read the instructions several times to ensure they understand the requirements.	IPG5: Attending classes
IP_PI17: Advise students to regularly attend classes to avoid missing any important information.	

Possible interventions for Cycle 1 and Cycle 2	Linked to guideline
IP_PI18: Request students to prepare any necessary text before coming to class.	IPG6: Preparing for lecture
IP_PI19: Encourage students to review the material while the lesson is still fresh in their minds.	IPG7: Studying after lecture
EC1P20: Encourage students to take notes while reading.	
IP_PI21: Instruct students to complete their assignments in order to avoid missing opportunities for learning and improving their grades.	IPG8: Completing assigned work.
IP_PI22: Motivate students to start afresh as soon as they realise that their work does not meet the specified objectives.	
IP_PI23: Request that students acquire accurate responses after being given their graded assignments.	IPG9: Acquiring correct answers
IP_PI24: Construct practical exercises that are meaningful and motivating to students so they can learn and improve their design skills.	IPG10: Enhancing design skills
IP_PI25: Ask students to complete practical examples and exercises to improve their practical skills.	
Assessment strategy to promote reflection.	
AS_PI1: Develop a case study that allows monitoring of students' progress and allows them to demonstrate their understanding of the current work.	ASG1: Monitoring student's reflection
AS_PI2: Use a reflective sheet or questionnaire to engage students in reflective questions about their work and the process they undertook.	
AS_PI3: Provide students with a rubric along with the assignment to assist them with what is expected and how their work will be assessed.	ASG2: Evaluation standards
AS_PI4: Use a rubric for evaluation to demonstrate achievement requirements for the students.	
AS_PI5: Give students feedback on their progress and encourage them to reflect on their work.	ASG3: Detailed feedback
AS_PI6: Use formative assessments (quizzes, tests, etc.) to provide feedback on learning.	
AS_PI7: Encourage students to incorporate reflection into their academic activities by regularly reflecting on their work.	ASG4: Reflective practice strategy

Possible interventions for Cycle 1 and Cycle 2	Linked to guideline
AS_PI8: Provide students with a reflective sheet after class for students to provide feedback for the lesson completed as part of their assignment.	ASG5: Post-lesson reflection
Overall instructional design orientation.	
ID_PI1: Integrate activities that are enjoyable and engaging (interactive games, role-playing scenarios, and group projects) into students' work.	IDG1: Enhance teaching quality
ID_PI2: Conduct theoretical lessons to foster the culture of learning theoretical content first to gain an understanding of the practical work.	IDG2: Lecture method
ID_PI3: Use presentation slides to direct the lecture to assist students in following the lesson.	IDG3: Presentation slides
ID_PI4: Use presentation slides to provide context for students to understand instead of relying on them as the sole source of notes.	
ID_PI5: Provide a description of the persona's function and context.	IDG4: Persona
ID_PI6: Create a narrative that depicts how the persona interacts with the product.	
ID_PI7: Construct a dialogue to assist students in understanding and relating to the persona.	
ID_PI8: Create cross-disciplinary learning settings for students to broaden their knowledge base and deepen their understanding of the application of design principles to various fields.	IDG5: Pedagogical concept
ID_PI9: Provide practical skills for students to apply theoretical concepts to real-life situations through practical activities.	IDG6: Theory-practice gap
ID_PI10: Prepare students for assignments by asking them to identify the main ideas in theoretical content and to think critically about what they are reading.	
ID_PI11: Give students a new assignment based on the work that they were taught recently.	
ID_PI12: Teach the students about the benefits of user experience for products.	IDG7: User experience
ID_PI13: Encourage students to incorporate user involvement as early as possible in the design process.	
ID_PI14: Request that students perform usability testing on their designs in order to gather user feedback for the purpose of making improvements.	
ID_PI15: Adapt your teaching approach to suit the needs of diverse learners and	IDG8: Maximise

Possible interventions for Cycle 1 and Cycle 2	Linked to guideline
maximize their potential.	students' potential learning
ID_PI16: Implement co-teaching to ensure that all students receive the necessary support and individual attention.	IDG9: Co-teaching
ID_PI17: Maintain a consistent understanding of the material and the strategies being taught.	
ID_PI18: Assign responsibilities and workloads.	
ID_PI19: Assess students together.	
ID_PI20: Consider both the achievements and obstacles in order to identify opportunities to enhance student learning.	IDG10: Evaluate your own teaching
ID_PI21: Improve teaching methods to keep up with the evolving educational requirements of students.	
ID_PI22: Assess the impact of your changes against your learning objectives.	
ID_PI23: Offer students the option to learn in an online or in-person setting to accommodate their learning style.	IDG11: Hybrid classes
ID_PI24: Incorporate a learning management system (LMS) for online teaching and learning.	IDG12: Online environments
ID_PI25: Provide students with access to resources such as videos, tutorials, and presentations.	
ID_PI26: Encourage collaboration among students by giving them group work that counts towards their final mark.	
ID_PI27: Record lectures for students to access them when needed.	

The possible interventions for cycle 3 were used for the interviews to evaluate the students' reflective skills. Table 9.12 provides an overview of the interventions that were developed from the actions taken during cycles 1 and 2.

Table 9.12: Possible interventions (Cycle 3)

Possible intervention	Reference from Cycle 1 and Cycle 2
Setting a specific assignment to bridge the theory-practice gap.	
C3TP_PI1: Find out if the reflective sheet helped the participants in making connections about what they learned in theory to practice.	C2TP_AI1: Students were involved in a task that allowed them to do self-inquiry by making connections about what they had learned in theory to apply in practice.
C3TP_PI2: Ask participants whether indicating how they applied what they had learned has assisted them in gaining more knowledge.	C2TP_AI2: Students were asked to indicate how they applied what they had learned.
C3TP_PI3: Inquire of the participants if the instances shown on how to integrate the principles into their tasks were helpful.	TP_AI1: HCI principles were taught, and examples were made to the students on how to incorporate them into the practical work.
C3TP_PI4: Ask participants if identifying users of the system assisted them.	TP_AI2: Students were asked to identify users of the system in the assignment.
C3TP_PI5: Ask participants if they were aware of the different social conditions of the users to consider during their designing process.	TP_AI3: Students were made aware of the different social conditions of the users to consider.
C3TP_PI6: Inquire of the participants whether it had been advantageous for them to demonstrate their understanding of the current work.	TP_AI4: A case study was provided for the students to demonstrate their understanding of the current work.
C3TP_PI7: Find out if the participants can brainstorm various methods for constructing a prototype	TP_AI5: Students were requested to brainstorm and sketch out their ideas;
C3TP_PI8: Inquire if the participants have the capability to develop a model that accurately depicts the actual system.	TP_AI6: Students were given an assignment that required them to create a prototype.
C3TP_PI9: Find out from the participants if they are capable of improving and revising their prototype until it is complete and suitable for submission.	TP_AI7: Students were advised to refine and iterate until the prototype was final and ready for submission.
C3TP_PI10: Request participants to evaluate if they are incorporating the theoretical concepts	TP_AI8: Students were required to identify the HCI theoretical content they used in their

Possible intervention	Reference from Cycle 1 and Cycle 2
and design principles in their work.	assignment.
Guiding reflection by and among students.	
C3RS_PI1: Request participants to formulate and write a plan on how they are going to apply what they have learned.	RS_AI2: Students were asked to indicate how they applied what they had learned.
C3RS_PI2: Find out if the participants were able to evaluate their prior knowledge and identify knowledge gaps using a reflective sheet.	C2RS_AI1: Students were given a reflective sheet to reflect on their learning to assess their prior knowledge.
General advice to students to improve performance.	
C3IP_PI1: Ask participants if being reminded to follow the guidelines stated in the study guide for the assessments assisted.	IP_AI1: Students were reminded to follow the guidelines stated in the study guide for the assessments. CUT (2021:8) manual states <i>“Read the question carefully; make sure you know what is being asked.”</i>
C3IP_PI2: Find out from the participants if they were following the instructions given to complete the assignment.	IP_AI2: Students were made aware to take note of the specifics of what they were being asked.
C3IP_PI3: Ask participants if they were successful in employing the schedule in the study guide to allocate their time effectively.	IP_AI3: Students were requested to follow the schedule provided in the study guide.
C3IP_PI4: Inquire if the participants understand the importance of starting the task on time to minimize distractions and procrastination.	C2IP_AI7: Students were requested to start the task on time to be able to go through the theory.
C3IP_PI5: Inquire of the participants if they plan in advance how they will complete the work given.	C2IP_AI8: Students were asked to draw up the plan on how they were planning to complete the assignment.
C3IP_PI6: Find out if the participants are researching the required information to use in their work.	IP_AI4: Activities that encourage students to conduct research about the work that they are doing were incorporated into the module in the form of an assignment.
C3IP_PI7: Ask participants if the due date assists them in completing the task on time.	IP_AI5: The due date was announced during class and also stipulated in the assignment.

Possible intervention	Reference from Cycle 1 and Cycle 2
C3IP_PI8: Inquire from the participants if they are using reputable sources when conducting research on the Internet.	IP_AI6: Students were advised to use reputable sources when researching.
C3IP_PI9: Ask participants if contacting the lecturer via WhatsApp and email has assisted them.	IP_AI7: The lecturer allowed students who were unable to come to campus to contact her via WhatsApp and email.
C3IP_PI10: Inquire from participants if they consulted the lecturer face-to-face on days the students had main module practical classes on campus.	IP_AI8: The lecturer was available for a face-to-face consultation on days the students had main module practical classes on campus (Tuesdays, Wednesdays, and Thursdays).
Assessment strategy to promote reflection.	
C3AS_PI1: Ask participants whether being provided with a rubric assisted with what was expected from them and how their work was going to be assessed.	AS_AI1: Students were provided with a rubric to guide them on how they were going to be assessed.
C3AS_PI2: Inquire from the participants if the feedback they received on their work encouraged them to reflect.	AS_AI2: Use formative assessments (quizzes, tests, etc.) to provide feedback on learning.
	AS_AI3: Detailed feedback was provided to the students to assist them in areas that needed improvement.
	AS_AI4: Students were requested to complete the reflective sheet after receiving feedback on their work.
C3AS_PI3: Ask students if they regularly reflect on their academic pursuits.	AS_AI5: Students were advised to regularly reflect on their work.
Overall instructional design orientation.	
C3ID_PI1: Request feedback on how participants plan to utilise the knowledge gained to further their professional development.	IDAI1: Lessons were related to the real-life experience that the students were able to relate to what they know.
C3ID_PI2: Inquire if the participants watched the tutorial videos that were provided for their use.	IDAI2: Lectures were recorded to allow students to access the session as needed.
	IDAI3: The students who were unable to attend

Possible intervention	Reference from Cycle 1 and Cycle 2
	due to a variety of circumstances were able to access the session at any time.
C3ID_PI3: Ask participants if the activities related to the theoretical content that they were taught assisted them in their understanding.	IDAI4: Students were given a practical activity to apply and gain a better understanding of the theoretical content they were taught.
C3ID_PI4: Ask participants whether the use of LMS assisted in their learning.	IDAI5: eThuto was used for students to access module content such as class presentations, tests, assignments, and classes.

The following section presents an evaluation of the research principles used in this study.

9.4 Evaluating Research Principles of the study

The research methodology employed in this study is critical social theory research. This study's methodology was based on the principles of critical and interpretive research. AR was also used for diagnosing, planning action, taking action, evaluating, and specifying learning to assess the suitability of the guidelines to develop HCI students as reflective practitioners. In Table 9.13, these principles are outlined, as well as an evaluation of whether they have been followed.

Table 9.13: Set of principles for critical research employed in this study adapted from Myers and Klein (2011)

Principle	Application in this study
The Element of Critique	
The principle of using core concepts from critical social theorists	The reflective practice model developed by Donald Schön was used to guide the students.
The principle of taking a value position	The researcher posited that HCI students will be inspired to utilise relevant theoretical content when engaged in practical activities. The data collected proved that the students were aware of the significance

Principle	Application in this study
	of using theoretical content in their practical activities.
The principle of revealing and challenging prevailing beliefs and social practices	The research aimed to investigate why students were not integrating theory and practice in their work and to explore the usefulness of reflective practice in bridging the gap between theory and practice in HCI. The literature revealed that a set of skills is required to know which principles to apply when designing interfaces; skills to create a prototype require practice.
The Element of Transformation	
The principle of individual emancipation	The study involved creating guidelines to develop reflective skills among HCI students and emancipating them by fostering their development as reflective practitioners. Emancipation was realised during AR Cycle 3.
The principle of improvements in society	Developing students as reflective practitioners contributes towards better HCI practitioners who develop usable and better user interfaces when they are working which will benefit the industry and ultimately benefit society.
The principle of improvements in social theories	The study contributed to the body of knowledge by providing the guidelines and the associated interventions relevant to HCI classes when developing students as reflective practitioners.

Interpretive data collection methods were employed for evaluation; therefore, the principles of interpretive field research were applied, as indicated in Table 9.14.

Table 9.14: Principles for interpretive field research employed in this study adapted from Myers and Klein (2011)

Principle	Application
The fundamental principle of the hermeneutic circle	The interpretation of the data from the reflective sheets and interviews took into consideration the relationship that emerged between each segment of the data with the rest of the data to establish the meaning of each. The question-answer circle was employed. Each response from a participant was evaluated with a holistic perspective, taking into consideration the participant's point of view.
The principle of contextualization	The understanding of the social and historical background of the phenomenon of interest for the participants was generated in Chapter 3. The participants' data was used to reflect the actual context of the study.
The principle of interaction between the researchers and the subjects	The gaps identified during the early AR cycles led to a better exploration of the phenomenon in the next cycles which initiated interaction between the researcher and the participants. Interviews were held in the third AR cycle.
The principle of abstraction and generalisation	Content analysis was used to develop concepts, generate theory, draw specific implications, and contribute to rich insights.
The principle of dialogical reasoning	Guidelines for developing HCI students as reflective practitioners were developed, using the existing theory and the actual findings.
The principle of multiple interpretations	During the analysis of the data in the AR cycles, the responses of the participants were analysed in order to confirm that the meaning based on the context is understood.
The principle of suspicion	Through a thorough analysis of shared and unique aspects in a diverse range of documents, the presence of multiple viewpoints was verified. One student blamed the Lecturer that he or she was not taught because they performed badly and other students stated that they applied what they had been taught during theoretical classes in their practical assignments.

The next section presents the limitations of this study.

9.5 Limitations of the study

The guidelines were evaluated during the COVID-19 period when all classes were held virtually. Some guidelines could not be evaluated, as explained in Chapter 7, Table 7.24. These guidelines can be implemented at another institution or with a different group of students in which face-to-face classes are conducted.

The participants of the study volunteered to take part in the study. The third AR cycle had a significant impact on the number of participants. The majority of participants from Cycle 1 and Cycle 2 did not write mid-year examinations and therefore did not qualify to register for the second-semester module. Therefore, the results of this study were affected by this. The researcher believes that the findings of the study represented only a small fraction of the overall opinions of the study participants.

9.6 Future research

This study successfully developed guidelines for developing HCI students into reflective practitioners. The guidelines were evaluated for their suitability using participants from the HCI class. The evaluation of the guidelines was context-specific, and the researcher took note of the guidelines that did not fit the context at that time. Other guidelines could not be implemented when the research was conducted. Unverified guidelines can be implemented at another university or with a different group of HCI students when there are no restrictions imposed by the COVID-19 situation.

The study can also be conducted in collaboration with other universities where lessons learned can be shared to improve subsequent AR cycles. Collaboration can provide diverse perspectives to this study. Future research can involve a longitudinal consideration; participants can be interviewed again when they are employed to assess whether they are integrating RP skills into their work.

9.7 Summary

The primary objective of this study was to formulate guidelines for developing human-computer interaction (HCI) students as reflective practitioners. Critical social

theory and action research were used to guide this study. In order to achieve the objective of the study, this was completed by diagnosing the problem first and reviewing the existing literature on RP and HCI to develop the guidelines that could be evaluated.

During the first AR cycle, the guidelines from Chapters 3, 4, and 5 were merged. Guidelines that had similar ideas were combined, and subsequently, all guidelines were grouped into categories. Five categories were created: *setting a specific assignment to bridge the theory-practice gap; guiding reflection by and among students; general advice to students to improve performance; assessment strategy to promote reflection; and overall instructional design orientation*. Possible interventions were developed for each guideline to address specific issues or challenges. The guidelines were evaluated for their suitability for achieving the objective of the study during the evaluation phase. When there was an absence of a guideline to align with the data collected from the participants, a new guideline was established. During the first AR cycle, some guidelines were verified. Those that were not verified and those that were verified but required further action were carried over to the second AR cycle.

In the second AR cycle, data were collected from the participants and the guidelines were verified in terms of their suitability to achieve the objective of the study. Guidelines that were not verified were used as input for the third AR cycle. By the end of the third AR cycle, participants achieved individual emancipation, as evidenced by the data showing that they consistently reflected on their studies.

The researcher completed the study, and the outcome of the study was the guidelines to develop human-computer interaction (HCI) students as reflective practitioners, along with the possible intervention for each. The guidelines assisted the students in bridging the theory-practice gap perceived in HCI classes and enabled their emancipation to be reflective practitioners.

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APPENDIX A: Ethical clearance



FACULTY OF ENGINEERING AND INFORMATION TECHNOLOGY
Department of Civil Engineering

APPLICATION FOR ETHICAL CLEARANCE TO CONDUCT RESEARCH IN THE FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

The Central University of Technology (CUT) Research Ethics and Integrity Policy applies to all undergraduate and post graduate students, and staff members who conduct research on CUT campuses and outside the campus. CUT policy bounds any person who wishes to conduct research with CUT students and/or staff but is not CUT affiliated to abide by the ethics framework. All CUT members who conduct research take responsibility to implement this Policy.

1. APPLICANT INFORMATION

1.1.	Title (Prof Dr /Mr /Mrs /Ms)	Ms						
1.2	Name(s) and Surname	Moretlo Tiale-Mkhize						
1.3	Student / Staff number	██████						
1.4	Department	Information Technology						
1.5	Campus	██████						
1.6	Postal address	██████████						
1.7	Contact details	Office ██████████ Cell ██████████ e-mail ██████████						
1.8	Supervisor (s)/Project Leader	Dr J Liebenberg Prof R Goede						
1.9	Qualification registered for/Level of research	<i>Please tick relevant option:</i> <table border="1"> <tr> <td>Masters qualification</td> <td>☐</td> </tr> <tr> <td>Doctorate</td> <td>☒</td> </tr> <tr> <td>Independent research (Non-qualification purposes)</td> <td>☐</td> </tr> </table>	Masters qualification	☐	Doctorate	☒	Independent research (Non-qualification purposes)	☐
Masters qualification	☐							
Doctorate	☒							
Independent research (Non-qualification purposes)	☐							
1.10	FRIC Approval Number (LS262a) (where applicable)							
1.11	Conflict of interest (Please underline/highlight): 1) Personal relationship Yes/No							

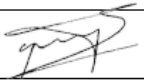
APPLICATION FORM FOR ETHICAL CLEARANCE: FEBIT

2) Financial benefit	Yes/No
If yes, please provide details:	

2. DETAILS OF THE STUDY

2.1	Approved/Proposed title of the study/project /dissertation/thesis
Guidelines for developing Human-Computer Interaction students as reflective practitioners	
2.2	Research question(s)
Attached on a separate document.	

APPLICATION FORM FOR ETHICAL CLEARANCE: FEBIT

2.	Ethical clearance number	FRIC: 2022/10(1)	
3.	Application approved subject to certain conditions. <i>Specify conditions below</i>		
4.	Application not approved. <i>Provide reasons for non-approval below</i>		
SIGNATURE: Chairperson: Ethics committee			
DATE		27/10/2022	

Cc Dean: FEBIT

ETHICS APPROVAL LETTER OF STUDY

Based on approval by the **Faculty of Natural and Agricultural Sciences Ethics Committee (FNAS-REC)**, the Faculty of Natural and Agricultural Sciences Ethics Committee hereby **approves** your study as indicated below. This implies that the North-West University Senate Committee for Research Ethics (NWU-SCRE) grants its permission that, provided the special conditions specified below are met and pending any other authorisation that may be necessary, the study may be initiated, using the ethics number below.

Study title: Guidelines for developing human-computer interaction students as reflective practitioners															
Study Leader/Supervisor: Dr J Liebenberg															
Student: MC Tlale															
Ethics number:	N	W	U	-	0	1	5	6	4	-	2	0	-	A	9
	Institution				Study Number						Year			Status	
Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation															
Application type: Single				Risk Category:				Minimal							
Commencement date: 01/02/2020															
Expiry date: 31/01/2025															
Approval of the study is initially provided for a year, after which continuation of the study is dependent on receipt and review of the annual (or as otherwise stipulated) monitoring report and the concomitant issuing of a letter of continuation.															

Special in process conditions of the research for approval (if applicable):

- The following documentation are archived by FNASREC and should be complete and kept up to date:
 - Research proposal
 - Signed approval from the scientific committee indicating the proposed risk category
- All researchers involved in the study should submit signed NWU code of conduct statements annually.
- All researchers of low risk studies should submit proof of relevant ethics training every two years.
- All researchers that take part in activities that pose a safety and security threat to the researchers or the environment should submit a risk assessment form annually.
- All research involving human interaction should follow best ethical practise and keep documents as proof. This includes informed consent, questionnaires, incorporation of risk-benefit, and responsible data management.
- Any research at governmental or private institutions, permission must still be obtained from relevant authorities and provided to the FNASREC. Ethics approval is required BEFORE approval can be obtained from these authorities.

General conditions:

While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, the following general terms and conditions will apply:

- *The study leader/supervisor (principle investigator)/researcher must report in the prescribed format to the FNASREC:*
 - *annually (or as otherwise requested) on the monitoring of the study, whereby a letter of continuation will be provided, and upon completion of the study; and*
 - *without any delay in case of any adverse event or incident (or any matter that interrupts sound ethical principles) during the course of the study.*
- *The approval applies strictly to the proposal as stipulated in the application form. Should any amendments to the proposal be deemed necessary during the course of the study, the study leader/researcher must apply for approval of these amendments at the FNASREC, prior to implementation. Should there be any deviations from the study proposal without the necessary approval of such amendments, the ethics approval is immediately and automatically forfeited.*
- *Annually a number of studies may be randomly selected for an external audit.*
- *The date of approval indicates the first date that the study may be started.*
- *In the interest of ethical responsibility, the NWU-SCRE and FNASREC reserves the right to:*
 - *request access to any information or data at any time during the course or after completion of the study;*
 - *to ask further questions, seek additional information, require further modification or monitor the conduct of your research or the informed consent process;*
 - *withdraw or postpone approval if:*
 - * *any unethical principles or practices of the study are revealed or suspected;*
 - * *it becomes apparent that any relevant information was withheld from the FNASREC or that information has been false or misrepresented;*
 - * *submission of the annual (or otherwise stipulated) monitoring report, the required amendments, or reporting of adverse events or incidents was not done in a timely manner and accurately; and / or*
 - * *new institutional rules, national legislation or international conventions deem it.*
- *FNAS-REC can be contacted for further information or any report templates via Roelof.Burger@nwu.ac.za 018 299 4269*

The FNASREC would like to remain at your service as scientist and researcher, and wishes you well with your study. Please do not hesitate to contact the FNASREC or the NWU-SCRE for any further enquiries or requests for assistance.

Yours sincerely,



Prof Roelof Burger
Chairperson Faculty of Natural and Agricultural Sciences Ethics Committee (FNASREC)

APPENDIX B: Ethics certificate

	Zertifikat	Certificado
	Certificat	Certificate
Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale Promoting the highest ethical standards in the protection of biomedical research participants		
	Certificat de formation - Training Certificate	
	Ce document atteste que - this document certifies that	
	Moretlo Tlale	
	a complété avec succès - has successfully completed	
	Introduction to Research Ethics	
	du programme de formation TRREE en évaluation éthique de la recherche of the TRREE training programme in research ethics evaluation	
Release Date: 2019/03/09 CTD : 146587024	 Professeur Dominique Sprumont Coordinateur TRREE Coordinator	
	Federatio Pharmaceutica Helvetica	 Continuing Education Program Programmes de formation continue
Ce programme est soutenu par - This program is supported by : European and Developing Countries Clinical Trials Partnership (EDCTP) (www.edctp.org); Swiss National Science Foundation (www.snf.ch); Canadian Institutes of Health Research (http://www.cihr-irsc.gc.ca/e/2891.html); Swiss Academy of Medical Sciences (SAMS/ASSM/SAMW) (www.samw.ch); Commission for Research Partnerships with Developing Countries (www.kfpe.ch)		



Zertifikat Certificat

Certificado Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants



Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Moretlo Tlale

a complété avec succès - has successfully completed

Research Ethics Evaluation

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2019/03/13
CID: e8MR0GACF

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator



Ce programme est soutenu par - This program is supported by :
European and Developing Countries Clinical Trials Partnership (EDCTP) (www.edctp.org) - Swiss National Science Foundation (www.snf.ch) - Canadian Institutes of Health Research (http://www.cihr-irsc.gc.ca/fr/2091.html) -
Swiss Academy of Medical Sciences (SAMS/ASOM/SAMW) (www.sams.ch) - Commission for Research Partnerships with Developing Countries (www.kfpe.ch)

(REV : 20170310)



Zertifikat Certificat

Certificado Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants



Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Moretlo Tlale

a complété avec succès - has successfully completed

Informed Consent

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2019/03/14
CID: P6t8C8wM

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator



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Swiss Academy of Medical Sciences (SAMS/ASOM/SAMW) (www.sams.ch) - Commission for Research Partnerships with Developing Countries (www.kfpe.ch)

(REV : 20170310)



Zertifikat Certificat

Certificado Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants



Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Moretlo Tlale

a complété avec succès - has successfully completed

South Africa

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2019/03/14
CID: 75621723C

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator



[REV : 20170310]

Ce programme est soutenu par - This program is supported by :
European and Developing Countries Clinical Trials Partnership (EDCTP) (www.edctp.org) - Swiss National Science Foundation (www.snf.ch) - Canadian Institutes of Health Research (<http://www.cihr-irsc.gc.ca/2991.html>) -
Swiss Academy of Medical Sciences (SAMS/ASMS/AMW) (www.sams.ch) - Commission for Research Partnerships with Developing Countries (www.kfpe.ch)

APPENDIX C: Consent form



Central University of
Technology, Free State

WELKOM CAMPUS
IT Department

Email: [REDACTED]
Tel: [REDACTED]
Cell: [REDACTED]

Dear Student

INFORMED CONSENT FORM: QUESTIONNAIRE

I would like to invite you to participate in my study entitled:

Guidelines for developing Human-Computer Interaction students as reflective practitioners.

The purpose of the study is to improve the teaching and learning of human computer interaction. You are hereby invited to participate in an interview about your reflective practice experience in the module of Graphical User Interface. The results of the interview are intended to contribute to the body of knowledge on this topical study.

Your participation in this study is voluntary. You may withdraw and discontinue participation at any time without penalty. No risks or inconveniences are anticipated from this study. All information will be treated as confidential without the disclosure of your identity. If you have any questions or concerns about participating in this study, you may contact me at the numbers listed above.

Permission was granted by the Central University of Technology, Free State to conduct this investigation.

Informed Consent
I, the undersigned, understand the nature of this study and agree to participate.

Participant Surname and Initials:

Participant Signature: _____

Date: _____

[REDACTED]

[REDACTED]



WELKOM CAMPUS
IT Department

Email: [REDACTED]
Tel: [REDACTED]
Cell: [REDACTED]

Dear Student

INFORMED CONSENT FORM: INTERVIEWS

I would like to invite you to participate in my study entitled:

Guidelines for developing Human-Computer Interaction students as reflective practitioners.

The purpose of the study is to improve the teaching and learning of human computer interaction. You are hereby invited to participate in an interview about your reflective practice experience in the module of Graphical User Interface. The results of the interview are intended to contribute to the body of knowledge on this topical study.

Your participation in this study is voluntary. You may withdraw and discontinue participation at any time without penalty. No risks or inconveniences are anticipated from this study. All information will be treated as confidential without the disclosure of your identity. If you have any questions or concerns about participating in this study, you may contact me at the numbers listed above.

Permission was granted by the Central University of Technology, Free State to conduct this investigation.

Informed Consent

I, the undersigned, understand the nature of this study and agree to participate.

Participant Surname and Initials:

Participant Signature: _____

Date: _____

[REDACTED]

APPENDIX D: Confirmation from editor

M: +27 (0) 72 285 8662
E: kefilwe.makhanya@gmail.com
A: 209 Crown Gardens | 1236 Bottrill Street | Queenswood
W: www.konibo.co.za



CONFIRMATION OF PROFESSIONAL EDITING

Date: 03 December 2023

I hereby confirm that I have edited the following PhD dissertation:

Student: Ms Moretlo Tiale-Mkhize
Title: Guidelines for Developing Human-Computer Interaction
Students as Reflective Practitioners
Institution: North West University
Faculty: Computer and Information Sciences
Supervisor: Dr JA Liebenberg
Co-supervisor: Prof R Goede

Kind Regards

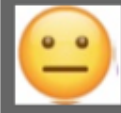
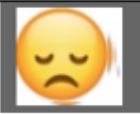
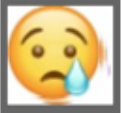
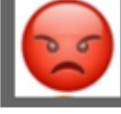
Kefilwe Makhanya
Editor

I started my career as a Lecturer in the Department of Communication at the University of Fort Hare in 1986. My areas of specialisation are Communication and Applied Linguistics. I have extensive, senior-level writing and editing experience in a broad spectrum of disciplines. For the past 8 years, I have focused specifically on editing non-fiction book manuscripts and academic work for senior students, researchers and academics from various SA universities and other parts of Africa.

APPENDIX E: Questionnaires

Diagnosis

1. How did you feel when you received your assignment back? Please select?

		Celebrating
		Excited
		Happy
		Relieved
		Neutral
		Disappointed
		Crying
		Angry
		Furious

2. Describe? (How did you feel when you received your assignment back?)
3. Did you have any prior knowledge and skills concerning your assignment?

4. What did you learn from the theory chapter in relation to your assignment?
5. Were you able to apply the theory chapter practically in the assignment?
6. If you could do this assignment over, what would you do differently?

Cycle 1 Questions

1. Which parts did you find most challenging while you were completing the assignment?
2. What did you do to solve your problems?
3. Which theory content did you relate your problems to? (Specify the theory in detail)
4. Did relating your problems to theory help? Elaborate?
5. What were the most important lessons you learned?
6. Is there anything that you would have done differently if there was more time? Elaborate?

Cycle 2 Questions

1. What steps are you going to take to complete the assignment?
2. What is the time frame for completing the assignment?
3. What theory part are you going to apply that will assist you in completing the assignment?
4. What is the most challenging part of the assignment? How are you going to solve it?
5. What resources are you going to need to complete your assignment?
6. How are you going to apply the knowledge or understanding you gained in this new assignment?

Cycle 3 Questions (Interviews)

1. What is your understanding of the concept of reflective practice?
2. What will you do differently if you were to repeat the Graphical User Interface module?
3. Were you able to improve your problem-solving abilities as a result of a reflective practice exercise? Please elaborate.
4. Understanding the question was mentioned as one technique to assist during the assessments. How did "understanding the question," assist you during the assessment?
5. Was it beneficial to use theoretical work to complete the practical assignment? Please explain your answer.
6. What were the most significant challenges you faced during the reflective practice process? Please elaborate.
7. Do you now plan before completing any assessment, or do you continue to carry out activities as previously? Please elaborate.
8. How will you apply what you've learned to advance your career?
9. Do you regard/view yourself as a reflective practitioner? Please elaborate.