Fake news awareness amongst students: an empirical study

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Abstract

Fake news is a term that describes news, stories, hoaxes, or other deliberately fabricated information that has been created to misinform or deceive readers. It has no factual basis, and although some fake news stories may include verifiable facts, it is presented in a way to deliberately push an untrue narrative. With the advent of social media, the spreading of fake news has increased, and popular media, such as Facebook, Twitter, TikTok, Instagram and others, have become some of the primary vehicles for spreading misinformation. The effect of fake news is severe and wide-ranging, as it impacts not only individuals, but also organisations and communities. One way to combat the spreading of misinformation and its associated negative consequences is to increase fake news awareness levels. It is particularly important to evaluate fake news awareness levels of young adults and students, as they are perceived as the most intensive social media users. In this study, a fake news awareness survey instrument is developed to evaluate the fake news awareness levels of a selected group of university students. The objective of the survey instrument is to determine whether students are able to recognise fake news. In addition, the survey also provides information on various other characteristics of fake news, such as the spreading of fake news, guidelines on how to educate people about fake news, general behaviour, and news preferences of students. The study is conducted using the design science research method, and the results show that it is possible to determine students' fake news awareness levels. The study resulted in several findings which led to formulating a set of recommendations that may be implemented to increase fake news awareness levels.

Keywords: Fake news, awareness, survey, questionnaire, social media

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Chapter 1: Problem statement

1.1 Introduction

Fake news is a term that has become widely used since 2016 and describes news, stories, hoaxes, or other deliberately fabricated information that has been created to misinform or deceive readers (Gelfert, 2018). In the literature, fake news is defined as any incorrect information that has no factual basis and has been created to mislead the readers into thinking that it is factual and real (Barclay, 2018). Some fake news stories include verifiable facts, but are presented in a way to deliberately push an untrue narrative.

Fake news was once relatively moderate in size, but with information becoming easily available and easy to access, this has caused fake news to explode in recent years, resulting in scams, hoaxes, and blatant false information becoming much more common on social media and other communication media. Misinformation, such as satirical pieces, propaganda and fabricated reports, have the ability to influence readers, even after being refuted (Lewandowsky *et al*., 2012). Even though fake news is not a new concept, it causes a major concern for the functioning of communities and requires new research to better understand the dangers of misinformation.

The spreading of false information or news can have serious consequences, such as negatively affecting a company's image and stock price (Merle, 2017), putting the public in danger by minimizing current world problems, i.e., COVID-19 (Faherty, 2019) fuelling propaganda and hate speech (Gu *et al.*, 2017), having a disruptive impact on democratic elections and referenda and undermining factual and true news (Ghaffary, 2020). There are numerous practical examples of fake news and the impact that it may have on society. Some of these examples include the 2016 US presidential election, where fabricated election content was presented as factual (Pennycook *et al*., 2020), i.e., a fake news bulletin that claims that Pope Francis endorsed Donald Trump for president. Although false, this story had a profound impact on how voters viewed the presidential candidates (Guess *et al*., 2018). Other fake news reports, such as a hacked Twitter news account, announcing United States president Barack Obama being injured in an attack on the Whitehouse caused the stock market to lose $136 billion (Baade, 2018). This forced national governments to start monitoring social media and other news sources in the hope of quickly responding to fake news before it could have an impact on the country.

The use of fake news can also have detrimental effects in other areas, such as national disasters or pandemics. During hurricane Sandy that hit the United States on 25 October 2012, it was reported that explosions occurred in which workers were trapped and that

subways would be closed (Holpuch, 2012). This news, which was untrue, was shared on social media and incited panic amongst many people. The current COVID-19 pandemic also led to a large quantity of false information. One such news item details how 5G cell towers are responsible for the outbreak of the pandemic. This led to widespread attacks on cell phone towers, some of which were not even 5G equipped, and put the lives of innocent people in danger (Faherty, 2019). Misinformation regarding the pandemic has also caused people to believe that the wearing of masks is unnecessary, thereby putting themselves and others in danger (Meiping, 2020).

Social media has become a popular way of creating and disseminating fake news (Meiping, 2020). Different studies recognised the power of social media and how it can be utilised to control people's opinions, by spreading certain information to make people believe certain things. For example, a concept, such as a "filter bubble" describes a phenomenon where people are not confronted with the full range of information, but are only provided with certain parts of the news that suits their interest and opinions. These "filter bubbles" are then used to "control" people's opinions, fears, and wishes (Rass, 2020). Other examples of studies that show the importance of fake news can be found in Chakravorti (2020), Clayton *et al*. (2019) and Fallis (2020).

The responsibility for spreading untrue news bulletins may be attributed to the different media platforms. However, many companies involved with mass media have for a long time been reluctant to combat fake news (Shu, 2019). The internet has given birth to many platforms where readers can easily access low-cost information to obtain daily news. Individuals may also post false narratives to many different sites in the hope of spreading false information or to obtain financial gain and it has therefore become important that social media platforms improve their ability to identify and report fake news, while spreading awareness to users on fake topics. For example, in a study by Guess *et al*. (2019), it was established that pensioners would frequently share misinformation without doing any research on the matter.

In an effort to combat the spreading of fake news, countries, such as the United Kingdom and Germany, have implemented different strategies, laws and regulations to minimise the effect of fake news (Goldberg, 2017). Another way to combat the use and spread of fake news is to make users of social media aware of the dangers of false news material and to equip them to recognise bogus information. Awareness campaigns and understanding of how users perceive potential false news items may help to mitigate the effect that fake news has on people. A higher level of awareness may have a positive impact on how people view social media posts and news and may lead to better identification of disinformation and the spreading of fake news.

Raising fake news awareness levels amongst university students is of particular interest, as social media, such as Facebook, Twitter, WhatsApp, Instagram, etc. has become an integral part of the daily life of university students (Lu, 2017). A study investigating the use of social media amongst students found that 95% of all students who participated in a survey use social media every day (Sutherland, 2018). The results indicate that university students can be easily influenced and persuaded by news articles published on social media. This is confirmed by a study conducted by Arab *et al*. (2019) who revealed that social media users who viewed cosmetic surgery-related material on social media are much more likely to consider undergoing cosmetic procedures. The evaluation of fake news awareness levels amongst young adults, and in particular amongst students, is therefore an important topic and contributes to the efforts to combat the spread and negative consequences of misinformation. A study by Leeder (2019) serves as an excellent example of the importance of the use of surveys to evaluate how students are influenced by fake news.

In line with the above motivation, the aim in this study is to evaluate the fake news awareness levels of a selected group of university students. A measuring instrument will be developed to gauge the awareness level of the selected group of students. To determine whether students are able to recognise fake news, the measuring instrument will contain fake, as well as authentic news stories that need to be identified by the respondents. Apart from awareness levels, the survey results will also provide information on various other characteristics of fake news, such as the spreading of fake news, guidelines on how to educate people about fake news, and general behaviour and news preferences of students, etc.

This chapter serves as an introduction to the study and the remainder of the chapter is organised as follows. In the next section (Section 1.2), the research question is formulated, followed by the research objectives in Section 1.3. The research design used to conduct the study will be presented in Section 1.4, while the ethical considerations are explained in Section 1.5. In the penultimate section (Section 1.6), an outline of the chapters of the dissertation is provided. The chapter is then concluded in Section 1.7 with a brief summary statement.

1.2 Research question

University students are intense users of social media and may use the internet for up to four hours or more on a daily basis (Kircaburun *et al.*, 2020). This makes them much more likely to be frequently exposed to fake news stories which circulate on social media. The focus of this study is to evaluate the fake news awareness levels of a selected group of students by developing a measuring instrument that can be used to assess fake news awareness levels. A survey will be performed, and appropriate mathematical and statistical techniques will be used to analyse responses. Therefore, the research question for this study can be formulated

as follows: *To what extent can fake news awareness levels amongst students empirically be determined?*

1.3 Research objectives

The primary objective of this research study is summarised in the research question and aims to determine the level of fake news awareness levels among a selected group of university students. The development of a survey instrument is proposed to be utilised to determine and evaluate fake news awareness levels.

To achieve the primary objective, several secondary objectives will be addressed. These secondary objectives include the following:

- Conduct a literature review on the various characteristics of fake news;
- Design and develop a measuring instrument to determine current fake news awareness levels of a selected group of students;
- Conduct a survey (amongst the selected group of students) to obtain the required and relevant data regarding their perceptions on fake news;
- Analyse the results of the survey using appropriate techniques; and
- Draw conclusions and make appropriate recommendations.

1.4 Research design

The *design science* research method will be used for this study. This methodology can be defined as a research paradigm in which a designer answers questions relevant to human problems by creating innovative artefacts, thereby contributing new knowledge to the body of scientific evidence (Hevner & Chatterjee, 2010). The research approach is fundamentally a problem-solving paradigm (Hevner *et al.*, 2004) which provides a clear structure and process steps that are used to complete a research study (Van der Merwe *et al*., 2020). The process steps include awareness of the problem, suggestions or possible solutions, development of an artefact, evaluation, and conclusion (Hevner & Chatterjee, 2010). Based on this five-step design science framework, the design science research paradigm is deemed suitable for this current study, as the steps coincide with the planned research, as formulated in the research question and research objectives.

The data used in the empirical study will be gathered from an online measuring instrument which will be used as the primary method for data collection. The goal of the measuring instrument will be to obtain relevant information from a selected group of students and to evaluate their levels of fake news awareness. Questions will be based on existing literature resources and will consist of a mix of Likert scale, dichotomous and open-ended questions.

1.5 Ethical considerations

A North-West University recommended online ethics training course was completed on 17 November 2020 by the author and included modules, such as *Introduction to Research Ethics, Research Ethics Evaluation,* and *Informed Consent*. Ethical clearance (minimal risk) was then obtained from the North-West University's Faculty of Natural and Agricultural Sciences Ethics Committee (FNAS-REC). An ethics number, NWU-00463-21-A9, was issued on 1 January 2021.

A selected group of university students will be used as participants in an online fake news awareness survey. Information gathered from participants will be kept confidential and will only be used to assist with the identification of certain characteristics of fake news. Furthermore, data will only be collected from participants who have provided consent; participants will remain anonymous and may withdraw their data at any stage and data gathered will be stored online in a safe and secure manner.

1.6 Dissertation layout

In this section, an overview of the remaining chapters of the study is provided by briefly describing the focus of the contents of each chapter.

Chapter 2 – Research design

The focus of Chapter 2 is the research methodology used in the study. The research method is evaluated and its suitability for the study is motivated.

Chapter 3 – Fake news: A literature review

The aim of Chapter 3 is to present a literature review on fake news. Aspects, such as the history and definition of fake news, goals of spreading fake news, technologies and platforms used to spread fake news, the impact of fake news, and current awareness levels of fake news are presented.

Chapter 4 – Development of a fake news measuring instrument

In Chapter 4, the development of a fake news awareness measuring instrument is described. The validation, by means of a pilot study, is also presented.

Chapter 5 – Fake news awareness survey

In Chapter 5, there is a detailed overview of the survey conducted to obtain the fake news information from the selected participants.

Chapter 6 – Survey results and discussion

The results and findings from the survey are described in this chapter. Appropriate mathematical and statistical techniques are employed to analyse the results and several recommendations pertaining to the fake news awareness levels of participants are formulated.

Chapter 7 - Conclusion

The final chapter contains a summary of how each research objective was achieved. Limitations of the study, as well as opportunities for further research, are also highlighted.

1.7 Summary

In Chapter 1, the study was introduced and an overview of the research problem, the research question, and the research objectives was presented. The ethical considerations were highlighted, and the chapter was concluded with a layout of the remaining chapters. In the next chapter, a detailed discussion of the research design and research methods employed in the study will be provided.

Chapter 2: Research design

2.1 Introduction

A structured and proven research method should be used to ensure that research results are reliable and of scientific value. A research method can be defined as a framework that is used by a researcher to guide the study and to provide the logic behind methodological choices made during the study (Collins & Stockton, 2018). The aim of this chapter is to present a brief overview of different research methods that are typically employed in research studies. The design science research method was selected as the approach used for this study and will be discussed in more detail. A brief introduction of three of the classical research paradigms is given at the beginning of the chapter. Thereafter, the design science method and how the current study is positioned within this approach are discussed. A brief overview of some of the methodological aspects of data acquisition and data analyses will also be provided.

2.2 Classic research paradigms

As mentioned in Section 2.1, the design science research methodology was chosen as the research method for this study. However, to provide some background and to contextualise the chosen methodology, a cursory overview of three classic research paradigms often employed by researchers will be presented in this section. The term paradigm was first used by Kuhn (1962) and describes a conceptual framework that is shared by more than one scientist. The framework is then used as a model to find solutions to new and existing problems. The three classical research paradigms commonly used in the scientific community that will be introduced here are the interpretivist paradigm, positivistic paradigm and critical social theory (Blanche *et al*., 2006).

2.2.1 Interpretivism

The interpretivist paradigm focuses on conducting research on humans and communities rather than objects (Saunders *et al*., 2009). It emphasises the nature of people's character and participation in both social and cultural life (Elster, 2007) and considers differences, such as cultures and circumstances (Alharahsheh & Pius, 2020). As such, the methodology is generally used by social science researchers where it is essential to look for meanings and motives behind people's actions rather than at the facts (Noor, 2008); i.e., the paradigm enables researchers to consider factors, such as behavioural aspects, based on participants' experiences.

The characteristics of interpretivism are summarised by Carson *et al*. (2001) as follows:

- Multiple realities exist and can be explored through human interactions;

- Human experiences, such as knowledge, views and interpretations result in many different social realities;
- Events are understood through mental processes which are influenced by interaction with different social contexts;
- A more personal collaborating mode of data collection is characterised by interactive talking, listening, reading and writing. Text messages, interviews and reflective sessions may be used as data collection tools; and
- Results are a product of the values of the researcher. Researchers should therefore remain objective and accept the viewpoints of participants without prejudice.

2.2.2 Positivism

Positivism was popularised during the 19th century by the French philosopher, Auguste Comte (Richards, 2003). The basic premise of positivism is that the social world can be understood in the same way that the natural world is understood – i.e., an observable reality exists from which generalisations can be inferred. To do this, positivistic research will often generate quantitative data which is used to answer research questions and to formulate theories (Rehman & Alharthi, 2016). Furthermore, positivists also seek to find rules and laws that make the social world more understandable (Grix, 2004).

According to Alharahsheh and Pius (2020), researchers who adopt the positivist paradigm are characterised by the following:

- Social entities (i.e., organisations) are viewed in the same way as physical objects or natural phenomena;
- Research is focused on the discovery and regularities that are observable and measurable; and
- Causal relationships are established among the data collected to formulate law-life generalisations. Fundamental universal laws and rules are used to support and explain research observations and results.

Positivism aims to reduce the complexity of the social world to simplicity by making certain assumptions and through a process of simplifying and controlling of variables. These methods, which are used to understand the natural world, are not always appropriate to understand the social world and may lead to specific challenges, such as the following (Alharahsheh & Pius, 2020, Saunders *et al*., 2009):

- Incorrect statistical tests (which is often dependent on a sample) can be misleading;
- Generalisations may ignore the intentions, perspectives, and actions of subjects (i.e., human beings); and

- Research findings in positivistic studies are often descriptive and in-depth issues may be neglected.

The current study presented in this dissertation has a positivistic nature and is subjected to both the characterisation and challenges, as summarised by Alharahsheh and Pius (2020). However, adopting the design science research approach is deemed appropriate to ensure that an accepted scientific and well-structured methodology is followed so that the positivistic challenges are addressed as best as possible.

2.2.3 Critical social theory

The fundamental objective of critical social theory is the improvement of the human condition. The methodology focuses on the liberation of individuals and tries to find alternatives to existing social conditions (Ngwenyama, 1991). Agger (2006) confirms this viewpoint and explains that critical social theory concentrates on identifying power relations, conflicts and contradictions. Reality is interpreted as a result of the cultural, political, ethnic, gender and religious factors (Rehman & Alharthi, 2016) and critical social theory attempts to remove any of these sources of alienation and domination (Agger, 2006). Furthermore, the paradigm is also a subjective approach that is further influenced by the researcher's historical experiences, cultural values, and personal views.

Ngwenyama (1991) argues that critical social theory is grounded in five fundamental assumptions. Adopting a critical social theory approach, these five fundamental assumptions will assist a researcher to collaborate with those affected while engaging in open debate and critical reflection. The five assumptions, according to Ngwenyama (1991), are as follows:

- People have the power to change their world;
- Knowledge of the social world is value laden;
- Reason and critique are inseparable;
- Theory and practice must be interconnected; and
- Reason and critique must be reflexive in practice.

2.3 Design science

Design science is fundamentally a problem-solving paradigm that has its roots in traditional sciences where the objectives are to create new artefacts to solve problems (Deng & Ji, 2018, Vom Brocke *et al*., 2020). The methodology therefore focusses on practical and real-world problem solving through the creation and evaluation of artefacts (March & Storey, 2008). The design science paradigm has been accepted and acknowledged as a fourth research paradigm (along with the three traditional paradigms discussed in Section 2.2) and is of particular interest in information systems research (Gregor & Hevner, 2013, Kwan, 2017).

Although this current study is closely related to the positivistic paradigm, it is believed that the artefact (a fake news awareness measuring instrument) that will be developed during the research process is of great importance and will contribute new knowledge in terms of understanding the spreading of fake news. Furthermore, the approach supports the idea of addressing a specific contemporary problem amongst university students. For these reasons, the design science research paradigm was chosen as the most appropriate methodology to conduct the study. The subsequent sections aim to provide an introductory discussion of the chosen paradigm and are structured as follows. A design science research framework is presented, followed by some guidelines for using the framework. The study is then positioned in terms of the methodology. A brief overview of the primary data collection technique used in the study, concludes the discussion.

2.3.1 Design science framework and approach

In general terms, a research project is a systematic study and investigation of a particular problem. To ensure that such a study is performed in a well-structured manner, it is essential to make use of an accepted research framework that provides clear guidance on phases, steps and outputs involved in the approach. In this study, the design science research methodology was chosen to guide the project and ensure that all research process phases are covered and reported on. There are several different design science process models that can be used – see for example Vaishnavi and Kuechler (2004) who listed a large number of other design science models. The work of Vaishnavi and Kuechler (2004), Peffers *et al*. (2008) and Hevner *et al*. (2004) is of particular interest to this study. The design science research framework suggested by Vaishnavi and Kuechler (presented in the ensuing paragraphs) will be used in this study while the work of Peffers *et al*. (explained in Section 2.3.2) is used to position the study in terms of the chosen methodology. The use of the guidelines proposed by Hevner *et al*. (presented in Section 2.3.3) will ensure the completeness of the design science research project.

The design science research framework proposed by Vaishnavi and Kuechler (2004) consists of five phases and is graphically illustrated in Figure 2.1. The five phases are awareness of the problem, suggestion, development, evaluation and conclusion.

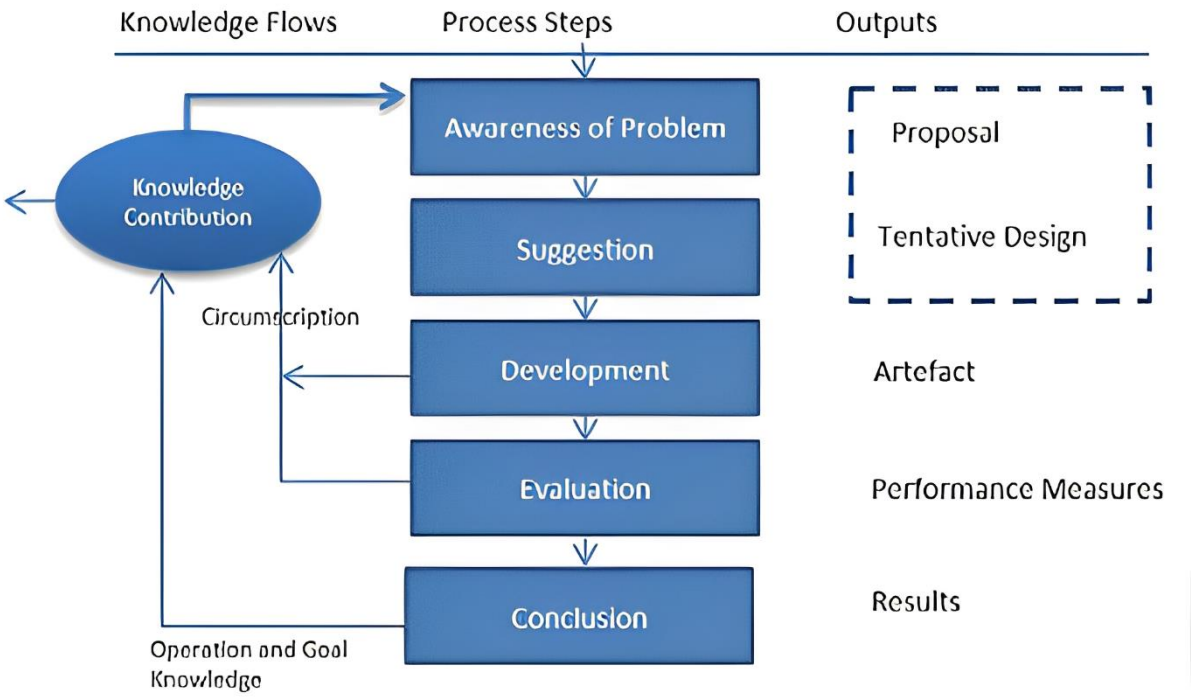

Figure 2.1 Design science research process model (Vaishnavi & Kuechler, 2004).

The five phases are eloquently summarised and explained by Botes and Goede (2014) and is reproduced below in Table 2.1.

Table 2.1 Design science research phases (Botes & Goede, 2014).

Phase	Description
Awareness of problem	Awareness may be drawn from multiple sources, such as new developments in the industry, a reference discipline, and reading in an allied discipline. Output: A formal or informal proposal for the new research effort.
Suggestion	Suggestion follows the proposal and is connected to it. Output: A tentative design.
Development	The tentative design is implemented; techniques for implementation vary depending on the artefact to be constructed. Output: An implemented artefact.
Evaluation	Evaluation of the artefact according to criteria.

	Output: Deviations from expectations, both quantitative and qualitative, tentatively explained.
Conclusion	Is the result satisfactory; i.e., although there may still be deviations, is the result acceptable? Output: A 'good enough' artefact.

2.3.2 Design science research guidelines

As with each problem-solving process, a design science research project also needs to be performed in a well-structured manner. The first step in this process is to use an acknowledged framework (presented in Section 2.3.1) that can guide the approach on a high level. However, to complement the framework and to ensure that the project is complete, a set of additional guidelines is needed. A group of seven guidelines for practising design science research can be found in Hevner *et al*. (2004) and will be introduced in this section.

Guideline 1 - Design an artefact: The main goal of design science research is to produce a viable artefact. Such an artefact may be in the form of a construct, a representation, a technique, a model, or a method.

Guideline 2 - Relevance of the problem: The essential requirement of design science research is to address a meaningful and relevant business problem and create a technology-based solution.

Guideline 3 - Design evaluation: The artefact must have specific characteristics; i.e., it must comply with utility, quality and efficacy requirements and these requirements must be demonstrated using appropriate evaluation methodologies.

Guideline 4 - Research contributions: A completed design science research project should offer new contributions. These contributions must be clear and verifiable in terms of the artefact and the methodologies employed.

Guideline 5 - Research rigour: This guideline requires the application of rigorous methods in both the construction of the artefact, as well as the evaluation thereof.

Guideline 6 - Design as a search process: The importance of recognising the design as a search process is imperative. It implies that the construction of (or search process to construct) an effective artefact should use all available resources while complying with the laws dictated by the problem environment.

Guideline 7 - Communication of research: The last guideline stipulates that the communication of the design science research project must be presented in an effective manner. Different audiences exist and communication should provide for both technology-orientated, as well as management-orientated people.

The seven guidelines (Hevner *et al*., 2004) are designed and formulated to complement the general framework and provide a benchmark against which the design science research project can be evaluated. In the following section, the positioning of the current study in terms of a design science research framework will be highlighted.

2.3.3 Positioning of the study

This study is conducted according to a design science research framework (Vaishnavi & Kuechler, 2007) together with appropriate guidelines (Hevner *et al*., 2004). To further clarify the methodology used in this study, the design science research framework proposed by Peffers *et al*. (2008) will be used to explain how the study is positioned in the framework. In this section, a brief mentioning of the Vaishnavi and Kuechler framework (discussed in Section 2.3.1) and how the various chapters of this dissertation fit in with the framework are given. This is followed by an explanation of the Peffers *et al*. model and its relation to the chapters of the dissertation.

2.3.3.1 The Vaishnavi and Kuechler (2007) framework

This framework was briefly explained in Section 2.3.1. To show how the seven chapters of this study are structured within the five phases, Table 2.2 below is presented.

Table 2.2 Application of dissertation chapters in the Vaishnavi and Kuechler (2007) framework.

Phase	**Description**	**Study chapter**
Awareness of problem	Awareness may be drawn from multiple sources, such as new developments in industry, a reference discipline, and reading in an allied discipline. Output: A formal or informal proposal for the new research effort.	**Chapter 1** – Problem statement that contains a formal research proposal. **Chapter 3** – A literature study serves as additional motivation for the proposal.
Suggestion	Suggestion follows the proposal and is connected to it. Output: A tentative design.	**Chapter 1** – The problem statement also proposed a solution, as well as a tentative design.

		Chapter 2 – The adoption of a formal design science research methodology contributes to the design of the study. **Chapter 3** – A literature study serves as additional motivation for the design.
Development	The tentative design is implemented; techniques for implementation vary, depending on the artefact to be constructed. Output: An implemented artefact.	**Chapter 4** – The development of a measuring instrument and the application thereof in **Chapter 5** constitute an implemented artefact.
Evaluation	Evaluation of the artefact according to criteria. Output: Deviations from expectations, both quantitative and qualitative, tentatively explained.	**Chapter 6** – The results, findings and recommendations will cover the evaluation of the artefact.
Conclusion	Is the result satisfactory; i.e., although there may still be deviations, is the result acceptable? Output: A 'good enough' artefact.	**Chapter 7** – The conclusion will show whether a 'good enough' artefact was created.

In the following subsection, the study is also positioned according to the Peffers *et al*. (2008) framework.

2.3.3.2 The Peffers *et al*. (2008) framework

It was stated in Section 2.3.1 that there are various design science research frameworks that can be used to conduct a study. Although the Vaishnavi and Kuechler (2004) framework forms the basis for this study, the study will also be positioned according to the Peffers *et al*. (2008) framework. Using two frameworks to explain the contents of the study will ensure that the seven chapters are well-structured and complete.

The model proposed by Peffers *et al*. consists of six activities and is graphically presented in Figure 2.2. Although this is a model that is structured in sequential order, Peffers *et al*.

(2008:56) also pointed out that "… there is no expectation that researchers would always proceed in sequential order from activity 1 through activity 6. In reality, they may actually start at almost any step and move outward".

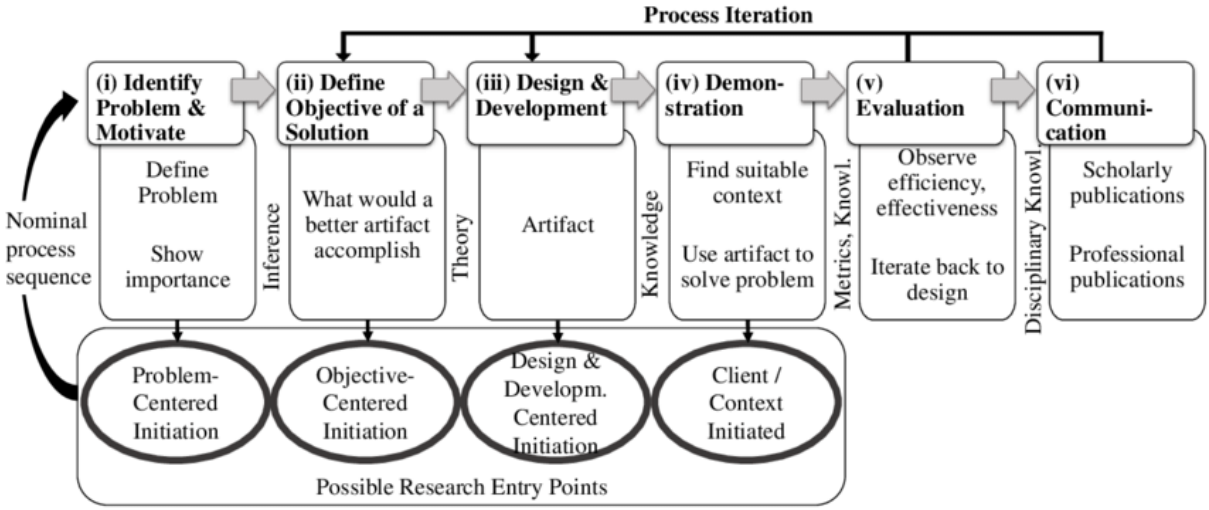

Figure 2.2 Design science research model according to Peffers *et al*. (2008).

The six activities and how the study is positioned within the Peffers *et al*. model, is explained in Table 2.3. The description of the activities is based on the work of Botes and Goede (2014), Peffers *et al*. (2008) and Vom Brocke *et al*. (2020).

Table 2.3 Study positioning according to the Peffers *et al*., (2008) model.

Activity	**Description**	**Study chapter**
Problem identification and motivation	A specific research problem is defined. The value of a solution needs to be justified in order to facilitate an understanding of the problem, as well as the motivation of the researcher (to seek a solution) and the audience (to accept the solution). To do this, both knowledge of the problem is required, as well as an understanding of the importance of the solution.	**Chapter 1** – A problem statement and research goals are formulated. **Chapter 3** – A literature study serves as additional motivation for the proposal.
Define the objectives of a solution	Objectives (quantitative or qualitative) of a solution are rationally based on the problem	**Chapter 1** – The problem statement also presents the main

	definition and knowledge of what is feasible.	objectives, based on the identified problem. **Chapter 2** – Adopting a formal design science research methodology contributes to the study's design and ensures that a rational solution and objectives are formulated. **Chapter 3** – A literature study serves as additional motivation for the formulated objectives.
Design and development	The artefact is created and should comply with the desired functionality and architecture.	**Chapter 4** – The development of a measuring instrument and the application thereof in **Chapter 5** constitutes an implemented artefact.
Demonstration	Demonstrate the artefact. The artefact should now be able to solve one or more instances of the problem. Solving a problem instance may involve a case study, experimentation, simulation, proof or any other appropriate activity.	**Chapter 6** – The results, findings and recommendations will cover the evaluation of the artefact.
Evaluation	Measures the artefact's performance by comparing the objectives of the solution with the actual results. May iterate back to step 3 to improve the effectiveness of the artefact.	**Chapter 6** – The results will indicate whether the performance of the artefact is satisfactory. **Chapter 7** – The conclusion will evaluate the complete study against the research objectives set in Chapter 1 and will draw conclusions about the performance of the study and the artefact in particular.
Communication	Use appropriate forms of communication to communicate	While **Chapter 7** will present the final conclusion and

	all aspects of the problem and the artefact to relevant stakeholders.	communication, the complete thesis (all chapters) will be employed to communicate all aspects of the study.

This concludes the introductory discussion on design science as a model for information systems research. In the section, the aim was to provide background information on some of the available design science models and to position the current study according to the selected models.

2.4 Data collection techniques

Data collection is one of the primary tasks to be performed in a research project. It allows a researcher to systemically obtain information that can be used to achieve the defined objectives (Lethbridge *et al*., 2005). There are several techniques available to collect data and according to Saunders *et al*. (2009) some of these techniques include the following:

- Interviews – a focused discussion between participants
- Questionnaires – participants are asked to respond to a set of questions
- Observations – an observation or recording of participants' behaviour
- Documents – includes written records, as well as non-written documentation, such as voice or video recordings.

Data collected through these different techniques may be classified as quantitative or qualitative data. More details regarding this grouping of data are presented in Section 2.4.3.

The primary data collection technique used in this study is through a questionnaire and a description of the use of questionnaires is therefore presented in the following sub-sections.

2.4.1 Questionnaire as a data collection technique

A questionnaire is one of the most common data collection instruments and is widely used in research studies (McKenna *et al*., 2011). It is simply described as a set of questions that aims to collect information from a number of respondents and may be distributed in various forms, such as a telephone questionnaire (researcher makes a phone call to a respondent to obtain a response), a mail questionnaire (sending a physical questionnaire request to a respondent), an in-house questionnaire (researcher visits the respondent's workplace/home to obtain a response), or an online questionnaire (respondents receive the questionnaire via email or any other online medium). In this study, an online questionnaire will be employed to collect data.

A general characteristic of a questionnaire is that it can either be a structured or unstructured questionnaire (Sadan, 2017). In a structured questionnaire, precise information is obtained through closed-ended questions where both the questions and responses are provided, and the respondent then needs to select the correct response. However, structured questionnaires may also have open-ended questions where respondents can provide their own answers. A structured questionnaire is used to collect quantitative data. In an unstructured questionnaire, respondents provide their own responses to predetermined questions. There is no limit on the responses and questions are more open-ended. This type of questionnaire is used to collect qualitative data.

A questionnaire consists of a predetermined set of questions that is presented to a participant in a specific order. There are several different types of question that can be utilised to collect the required data. According to Sadan (2017), examples of the different types of question include the following:

- Dichotomous questions – respondents have to choose between two choices; i.e., yes or no.
- Multiple-choice questions – alternative responses to each question are available and respondents select one or many from the given list of options. Answer choices may also be images in which case it is referred to as a pictorial question.
- Rank order questions – respondents select an answer along a continuum; i.e., least important to most important.
- Forced-choice questions – participants are forced to choose between two related statements.
- Rating questions – an evaluation on a given ordered continuum of responses; i.e., from 0 to 10.
- Visual analogue scale – used to record subjective experiences, such as pain, happiness, satisfaction, etc.
- All the above examples are classified as closed-ended questions. Open-ended questions are questions where participants provide their own answers in a free form without any restrictions.

In order to measure the characteristics or traits of participants, scales are used. There are several different scales that can be utilised in a questionnaire (Sadan, 2017) and some of the more popular examples include a rating scale (used to rate an attribute or feature), Likert scale (used to indicate the degree to which a respondent agrees or disagrees with a statement), and semantic differential scales (to gauge the connotative meaning of a phenomenon; i.e., satisfied

vs unsatisfied). The different scales are associated with different types of data which will be elaborated on in Section 2.4.3.

2.4.2 Guidelines to develop a questionnaire

The development of a questionnaire is an important task. It needs to be done in a structured manner and by using appropriate methods to ensure an acceptable quality of both the questionnaire and the results (McKenna *et al*., 2011). Various aspects need to be taken cognisance of; i.e., the format in which the questionnaire will be administered (Tsang *et al*., 2017), should be easily understood by respondents (Davis *et al*., 1994), types of question and how the questions are presented; i.e., questions should be simple, short, and written in a language familiar to respondents (Hinkin, 1998), the length of the questionnaire should be sufficient to gather the required information without causing fatigue or loss of motivation to respondents (Schultz *et al*., 2005), and ensuring that content validity is addressed (McKenna *et al*., 2004).

To ensure that most of the basic requirements of a questionnaire are covered, Artino *et al*. (2014) suggest that the following simple guide may be of assistance:

- Use short and simple sentences.
- Ask for only one piece of information at a time.
- Avoid negatives if possible. An example of the formulation of a negative question is as follows: In the last 24 hours, how many times did you not use social media?
- Ask precise questions.
- Avoid unnecessary details, as people are usually less inclined to complete long questionnaires; however, ask for all the essential information.
- Avoid using statements instead of questions.
- Avoid using agreement response anchors.
- Avoid using too few or too many response choices. Use five or more response choices when making use of a Likert scale system.

To formalise the development of the questionnaire in this study, the guidelines offered by Oates (2006) were followed. These guidelines, which consider all the above-mentioned aspects, include the following:

Form of administration. Two main categories of administration exist. An online questionnaire, such as the one that is used in this study, is a self-administered questionnaire. Other examples of self-administered questionnaires include a mail questionnaire or an in-house questionnaire. A telephone questionnaire or a structured interview is termed an interviewer-administered questionnaire.

Question content and wording: As mentioned earlier, questions should be specific, brief and relevant and care should be taken that data, relevant to the subject, is generated by the questionnaire. The latter is also referred to as content validity.

Question types: Questions can be formulated to generate factual data provided by a respondent; i.e., a closed-ended question, or to generate opinions, i.e., an open-ended question.

Question and response format: Appropriate question and response formats should be used. There are a number of different formats that can be used and examples, as discussed earlier, may include dichotomous questions, multiple-choice questions, rank order questions, rating scales, Likert scales, etc.

Layout and structure: The questionnaire should start with a background or introduction section that explains the purpose of the research project and the questionnaire. Clear instructions on how to complete the questionnaire, as well as information on aspects, such as confidentiality, voluntary participation, etc. should be given.

Validity and reliability: Reliability refers to whether the same results will be obtained if the questionnaire is repeatedly given to the participants. There are two types of validity; i.e., content validity (do questions cover the domain studied) and construct validity (do the questions measure what is expected to be measured). McKenna *et al*. (2003) state that content validity can be tested via a small set of questions, such as the following:

- Are the questions clear and easy?
- Did the questions cover all the problem areas of your study?
- Would this questionnaire benefit other researchers for future assessments?
- Does the questionnaire lack important questions that could provide meaningful data?
- Do some of the questions violate the privacy of respondents?

The use of questionnaires as data collection method offers several advantages over some of the other techniques. However, there are also a few disadvantages. Table 2.4 below, based on the work of Sadan (2017), summarises some of the advantages and disadvantages.

Table 2.4 Advantages and disadvantages of questionnaires.

Advantages	**Disadvantages**
As it is less expensive, the use of a questionnaire is more cost-effective.	Requires time and effort to develop. Incomplete information, as participants may not complete all questions.

Requires less time and effort to administer a questionnaire as opposed to, for example, an interview. Using an online or electronic medium, the use of questionnaires is a fast way of collecting data. A larger number of participants can be reached. Complete anonymity. Less biased as opposed to, for example, an interview.	Questionnaires normally result in lower response rates.

As mentioned in the preceding sub-sections, the different data collection techniques, measuring scales, etc., are associated with two classes of data; i.e., quantitative and qualitative data. The next section will introduce these two classes of data.

2.4.3 Qualitative and quantitative data

Data collected via questionnaires provide actionable insight to operations functions, such as the planning of campaigns, understanding specific behaviour and phenomena, launching new products or services, etc. In this study, a questionnaire is developed to understand the spreading of fake news and it is imperative to understand the two main classifications of data; i.e., qualitative and quantitative data. Saunders *et al*. (2009) define quantitative data as a data collection technique or data analysis procedure that generates or uses numerical data, while qualitative data is defined as a data collection technique or data analysis procedure that generates or uses non-numerical data.

The two main types of data are further subdivided into different sub-types. This classification of data types can be presented graphically as in Figure 2.3. In the remainder of this section, there will be a brief definition each of the sub-types, as indicated in Figure 2.3. The descriptions and definitions will be based mainly on the work of Saunders *et al*. (2009). The section will then be concluded with a summarised list of differences between qualitative and quantitative data.

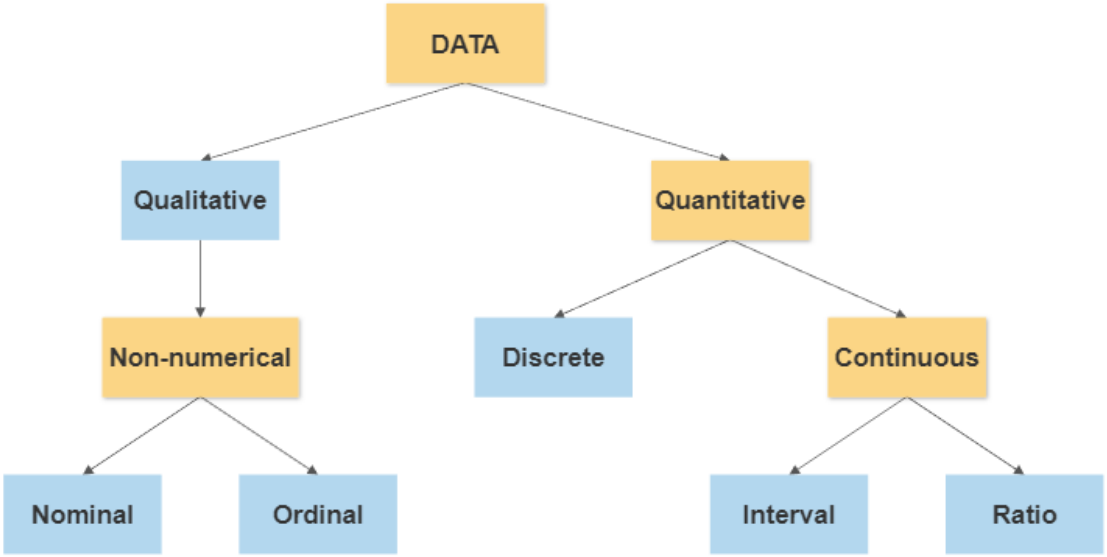

Figure 2.3 Data types.

As already mentioned, qualitative data refers to non-numerical data. There are two types of non-numerical data, namely nominal and ordinal data. The name "nominal" comes from the Latin word "*nomen*" which means "name", and nominal data, therefore, is used to name or label specific variables in no particular order. This type of data is used primarily to count the number of occurrences in a particular category. An example of nominal data is marital status (i.e., married, single, divorced, widowed). In the case of only two categories, i.e., gender which may be male or female, nominal data is also referred to as dichotomous data. Ordinal data is a more precise form of categorical data. In this case, a number, to indicate position or sequence, is associated with each category. This means that based on a relative position of the data value, a number can be assigned to it; i.e., competitors in a race can be first, second, third, etc., or financial risk may be high, medium or low. No calculations or arithmetic operations can be performed on the numbers in ordinal data.

Quantitative data refers to numeric data and can be subdivided into discrete or continuous data. Discrete data is data that can be measured precisely, generally through a counting process. The data is integers and comes from a finite set of possible values. Examples are the number of chairs in a room, number of workers in a department, etc. As opposed to a counting process, continuous data is data that is obtained through a measuring process. A continuous variable can theoretically take on any value within an interval and examples include distance, height of people, speed, gas consumption, etc. Continuous data are further subdivided into two categories; i.e., interval and ratio data. Interval data enables a researcher to state the difference (interval) between two data values. However, this type of data has no

meaningful zero, meaning that values can be added or subtracted, but not multiplied or divided. Saunders *et al*. (2009) use the Celsius temperature scale to explain this. The difference between 20^0C and 30^0C is 10^0C, but this does not mean that 30^0C is one and a half time as warm as 20^0C. The reason being that 0^0C does not represent a true zero; even at 0^0C there is still some warmth. Another example of interval data is a time period; i.e., from 7:00 to 19:00. In contrast, ratio data do have an absolute zero and the ratio between any two data values can be calculated; i.e., a profit of R300 in time period 1 and a profit of R600 in time period 2 means that profits have doubled.

The most significant differences between quantitative and qualitative data are summarised by Saunders *et al*. (2009) and are presented in Table 2.5.

Table 2.5 Quantitative and qualitative data.

Quantitative data	**Qualitative data**
- Based on meanings derived from numbers. - Collection results in numerical and standardised data. - Analysis conducted using diagrams and statistics.	- Based on meanings expressed through words. - Collection results in non-standardised data requiring classification into categories. - Analysis conducted using conceptualisation.

In this sub-section, a brief introductory discussion on the differences between quantitative and qualitative data was provided. It is essential to understand the differences to ensure that the correct statistics are generated and appropriate analytical techniques are used.

2.5 Summary

The aim of this chapter was to provide an overview of the research methodology that is followed in the study. A brief outline of the classic research paradigms was presented with a more detailed discussion of the design science research methodology. Data collection in general and questionnaires specifically, were discussed, while the differences between quantitative and qualitative data were also highlighted.

In the next chapter, a literature contextualisation of fake news and its impact on individuals and communities will be presented.

Chapter 3: Literature study

3.1 Introduction

Various online media platforms have in recent years caused an increase in the creation and distribution of fake news and have become a worldwide concern. The consequences of fake news are often serious and can lead to large scale damage to individuals and businesses alike.

As explained in Chapter 1, the main goal of this study is to investigate the impact of fake news on students and the awareness levels of fake news amongst students. To do this successfully, a thorough background study needs to be completed on fake news and the influence it can have on individuals and communities. It is also important to provide a brief overview of current and completed studies regarding fake news and the methods and techniques employed to address the problem.

The aim of this chapter is therefore to present descriptions of key aspects and characteristics of fake news and the role of fake news in everyday life. Aspects, such as a definition of fake news, motives and methods behind spreading fake news, as well as various different strategies to combat the spread of fake news, will be presented. The chapter will then be concluded with a brief overview of current studies regarding fake news with an emphasis on knowledge levels and the evaluation of fake news awareness levels.

3.2 Definition of fake news

Fake news as a phenomenon is not new, but the tools and methods used to spread and create fake news have seen drastic changes over recent years (Posetti & Matthews, 2018). Society has always been subjugated to the deformation of facts, biased information and the misuse of advertising information to discredit beliefs and values of certain groups or individuals. As early as during Roman times, well-known figures, such as Julius Caesar, used propaganda to better their image to the public and sway public perception about them and their deeds. During the 17th century, a French newspaper, *The Canard*, sold fake news that eventually led to the establishment of illegal underground newspapers (De Baets, 2018). This practice was continued by others, for example, during the 19th century, journalists in Germany created interesting (but false) stories that could boost sales figures. From these examples it seems that the main goal of fake news was related to economic and financial reasons.

Currently, the internet era provides new means for publishing and monetising fake news on a much greater and vastly increased scale (Burkhardt, 2017). The internet and affordable computers have made it possible for anyone to publish his/her information to an audience instantly. The many hoax web sites that are spread across the internet have turned fake news

into a global problem. In addition, social media has made tools available that are being misused to reach even more uninformed readers. These readers will often spread fake news to further a fake narrative, gain a political advantage or to gain financial benefits (Zimmer *et al*., 2019).

Fake news has fooled and influenced many people over recent years when it comes to important international events, such as presidential elections or even small community news. To illustrate the ease and the magnitude of using fake news, a few examples are quoted here. An untrue statement, published on Facebook, claiming that the Pope had released a statement in support of a republican candidate during a United States election, was shared more than 900 000 times (Watson, 2020). A similar hoax, claiming that the president of the United States of America was planning to cut $2.6 billion from various poverty programmes, was shared more than 2 200 000 times on Facebook (Watson, 2020). It is clear that Facebook has been one of the biggest perpetrators in social media for spreading fake news. A team of researchers tracked the internet usage of 3 000 American citizens and found that Facebook would refer to untrustworthy news sources more than 15% of the time while only referring to authoritative news sites 6% of the time (Travers, 2020). These numbers are far worse than other social media sites, such as Twitter, which shared 1% untrustworthy news sites versus 1.5% hard news (Travers, 2020). Guess (2018) estimates that over 27% of the voting population of the United States of America view fake news that is specifically created to influence people's voting opinions. These fake news stories trying to influence people's voting opinions were shared on many social media platforms, such as Instagram, TikTok, Facebook and Twitter.

Fake news has been defined by various researchers in the literature. Some of the definitions include fake news is news that has deliberately been presented as false or news that is by design, misleading (Gelfert, 2018). All disinformation should be regarded as fake news if it was created or spread purposefully with the intent to deceive (Knight Foundation, 2018). Fake news manifests according to its dimensions of facticity and deception, namely news, satire and parody, manipulation, fabrication, advertising, and propaganda (Tandoc *et al*., 2018) and fake news includes intentional reporting mistakes, rumours with no evidence, conspiracy theories, satire that could be misinterpreted as genuine and false statements by politicians (Allcott & Gentzkow, 2017). In this study, the definitions offered by Gelfert (2018) and Allcott and Gentzkow (2017) will be accepted as a standard definition for fake news and will be used as a guideline in all subsequent chapters.

3.3 Motives to spread fake news

Different motivations exist for spreading fake news (Burkhardt, 2017). Although motivation may be linked to different personality types, the result of spreading fake news usually has a drastic impact on individuals and groups of people. In this section, five of the well-known motives are briefly discussed. Readers interested in a more comprehensive overview of the psychological aspects of motivation associated with behaviour are referred to Axt *et al*. (2020). The five motivational factors that will be discussed in this section include: enjoyment, financial gain, political power, celebrity worship and the spreading of awareness and trust.

3.3.1 Enjoyment

Occasionally the sharing and creating of fake news has nothing to do with financial or political gain, but more with psychological and emotional aspects. For example, there are social media users that find great enjoyment from fooling others into believing fabricated false news stories which they themselves have created or have seen online. The anonymity that comes with many social media platforms allows these users to do and say whatever they want and even practise a degree of cybercrime without any repercussions (Armstrong & Forde, 2003). An example of an enjoyment-driven case can be found during the recent Coronavirus lockdown period. Certain users would send fake text messages that appeared to be a government text, telling citizens that the first person to receive a COVID-19 vaccine has died due to an allergic reaction. This caused major panic for households and communities and ultimately forced local governments to issue statements to inform people of the true circumstances (Spring, 2020).

3.3.2 Financial gain

One of the most prominent motivational factors for creating or spreading fake news is financial gain (Burkhardt, 2017). An example of this can be found in the use of hoax news sites that are used to defraud online advertisers by promising more visitors to their web sites. Fake news web sites promise online advertisers that their advertisements will be viewed by many people on their site (Braun & Eklund, 2019). These visitors are attracted by fake news headlines on social media and will visit the site where the advertisements are displayed. The online advertisers will then in return pay the publishers of the hoax news sites. Another example of financial gain is the use of fake news to influence the stock market. During 2013, a total of $130 billion was lost due to a tweet from a hacked Twitter account. The Twitter account claimed that a large explosion had injured the president of the United States of America which caused financial markets to react to the news before verifying if it was true (Rapoza, 2017). Similarly, a mistaken ABC news report in 2017 claimed that the current National Security Adviser of the USA would testify against the president of the USA and therefore open the door for a possible impeachment of the president. This caused the S&P 500 to lose $341 billion.

Only after the news was retracted, the loss shrank to $51 billion (McElhaney, 2019). Many fake news web sites aim to have a similar effect on the stock market by spreading fake news. For example, Kogan *et al.* (2018) describe how these fake news publishers react, by buying shares while the stock is falling in anticipation of the stock market recovering after the news has been revealed as fake.

3.3.3 Political power

The phrase fake news has been used by politicians around the world to describe news that they feel is disagreeable or does not benefit them (Wardle & Derakhshan, 2017). The former president of the United States, Donald Trump, would often describe news painting him in a negative light as fake news, in the hope that his supporters would not read these news articles (Bovet & Makse, 2019). Fake news can also be used during election campaigns by supporters to dissuade voters from voting for their candidate. Gunther *et al.* (2018) calculated in his study that 4% of the previous democratic candidate's voters were dissuaded from voting for the democratic candidate in 2016 by fake news shared on social media. In 2016 South Africa's Public Protector published a state capture report, detailing how South Africa's government was being controlled and taken over. As a result, many fake Twitter accounts created fake counter allegations, denouncing the Public Protector's findings in support of the president of South Africa and individuals who tried to take control of the government (Wasserman, 2017). This is a clear example of how fake news and social media were used to gain political power for the former president of South Africa.

3.3.4 Celebrity worship

Celebrity worship is defined as an obsessive fascination with a famous person (Zsila & McCutcheon, 2018). Fans with this obsessive behaviour are quick to believe anything the celebrity endorses or talks about on social media or in person (Kader, 2018). When the celebrity post fake news on social media, his/her fanatical fans would help spread it across other social media platform, believing it is real (Kader, 2018). A study by Brennen *et al*. (2020) with the Reuters Institute for the Study of Journalism concluded that celebrities were responsible for 69% of social media engagement around Coronavirus misinformation. The celebrities' large social media following, along with their fanatical fans, are perceived as the key reasons for the spread of the fake news.

3.3.5 Awareness and trust

Social media users could have various motivations for sharing news and contributing to different types of social media (Oh & Syn, 2015). Many users share their social media news immediately, in the hope of spreading instantaneous awareness of what they feel could impact others, before taking the time to authenticate the news (Talwar *et al*., 2020). During a 6.5-

magnitude earthquake in Indonesia, fake news spread from concerned family members, trying to warn of a bigger tsunami-generating quake. Although this news was fake, it resulted in thousands of residents staying in shelters (Kwanda & Lin, 2020).

People who value their reputation and trust in a social group, will often want to share useful or entertaining information to increase their value in the social group (Fehr & Fischbacher, 2003). Others try to share news that is consistent with their beliefs and will share these news articles even if they are explicitly flagged as false (Moravec *et al*., 2019). These users tend to not feel the need to verify the information that they share, either thinking it is unnecessary or because they believe that it is true (Buchanan, 2020). For example, Guess *et al.* (2019) described a study where analysing Americans with a history of voting Republican resulted in them being more likely to endorse and disseminate right-wing messaging, even if the information were false.

3.4 Methods of spreading fake news

Fake news can spread rapidly among communities and online platforms. Studies have indicated that fake news is more likely to spread faster and wider than legitimate news, thanks to certain factors accelerating the spread of fake news (Zhang *et al*., 2019). In this section, some of the more prominent technologies and techniques used to spread fake news will be presented.

3.4.1 Software

There is a large number of free software options, as well as software that can be purchased, available to rapidly spread fake news. The software ranges from free alternatives, such as those found in social media, to more sophisticated software, such as social bots and artificial intelligence algorithms that may create deep fakes to spread fake news.

The more sophisticated software is of particular concern because it may have a significant impact on the creation and distribution of fake news. Social bots, for example, are increasingly used by fake news web sites to publish and spread articles with fake contents to lure more visitors to their web sites (Shao *et al*., 2017). A social bot is an automated program that can produce fraudulent web sites and high volumes of software-controlled profiles, pages or posts (Chengcheng *et al*., 2017). Furthermore, they are also able to control semi-automatized accounts on social media and post content and interact with social media users, masquerading as real people (Assenmacher *et al.,* 2020). Well-known examples of social bots include the virtual assistants *Siri* (developed by Apple) and *Alexa* (developed by Amazon) (Hepp, 2020). The subject of social bots, as it is used in the context of fake news, is an important field of study and many research projects on this topic can be found in the literature. For example,

Hagen *et al.* (2020) analyse how social bots can be used to influence political discussion, while Schuchard *et al.* (2019) discuss the influence this type of software has on social media. Other examples of related studies can be found in Wang *et al*. (2018), Shao *et al*. (2018), Reuter *et al*. (2017) and Arnaudo (2017).

A recent development in the field of artificial intelligence that also plays a major role in the creation and spreading of fake news is deepfakes. Deepfakes are a kind of artificial intelligence that rely on deep learning neural networks to analyse large sets of data samples. Deepfakes learn to mimic a person's facial expressions, mannerisms, voice, and inflections through these data samples (Westerlund 2019). Furthermore, using deepfake techniques, it is possible to produce realistic pictures or videos resembling a specific person with an associated synthetic audio of the person's voice. This newly created fake image of a person can then be used to spread fake news; i.e., the fake image may announce or say untrue things, which may have serious consequences, as people may not be aware that the image is fake.

Images and videos have generally been considered to be reliable sources that could be used in court or police investigations and have been a mainstay in news reporting and other forms of journalism (Albahar & Almalki, 2019). However, with the improvement of deepfake technology, these images and videos can now help to enhance the phenomenon of fake news (Alibašić & Rose, 2019). This technology can be used by politicians and celebrities to deflect or divert attention from their negative actions, while also diminishing the reliability of the news (Albahar & Almalki, 2019). Deepfake technology can also be used to damage the image of political figure and celebrities. Spivak (2019) discusses how an anonymous individual was able to deepfake images of celebrities onto the bodies of adult video stars in pornographic films. Spivak also stated that the US Ambassador to Russia was the target of a Russian disinformation campaign by editing pictures and splicing speeches using deepfakes.

Fallis (2020), highlighting the dangers of deepfakes, analysed just how people tend to make decisions based on knowledge they acquired from videos. The study analyses how people can easily acquire false beliefs from deepfake videos, but also prevent people from acquiring truthful knowledge. These people, even after watching a video, would often second guess the information, in case of the video being fake. Fallis concludes that with the rise of fake news and more deepfakes, it will become more difficult for people to trust the information they receive from videos.

An online survey conducted by Vaccari and Chadwick (2020) exposed subjects to deceptive deepfakes to determine how easily they might be deceived. The study concluded that deepfakes may not necessarily deceive individuals, but they may sow uncertainty which may, in turn, reduce trust in news on social media. A current cause for concern is the ever-increasing

quality of deepfakes and that it may deceive more individuals in the future. A survey by Nguyen *et al.* (2020) analysed algorithms used to create deepfakes and proposed methods to detect deepfakes. A key research point was how detection methods are still in the early stages of development and how deepfakes can erode the trust people have in media. The study highlights the need for detection methods to improve with the ever-increasing quality of deepfakes, while encouraging studies on understanding the intent of people publishing deepfakes.

3.4.2 Attracting an audience through emotion

Fake news can be made to be significantly more impressive, sensational and inflammatory to evoke different emotions in readers. These different emotions, such as suspicion, anxiety and shock will encourage them to share the information with others (Zhang *et al.*, 2019).

A study analysing the emotions of readers when reading fake news in comparison with real news, found that fake news would incite much more anger and sadness as shown in Figure 3.1. In contrast, real news would incite much more happiness and the comments on the news would be more positive (Zhang *et al.*, 2019). Figure 3.2 shows that fake news articles specifically target certain emotions, such as anger, which encourages users to comment on the posts and to share them with other people.

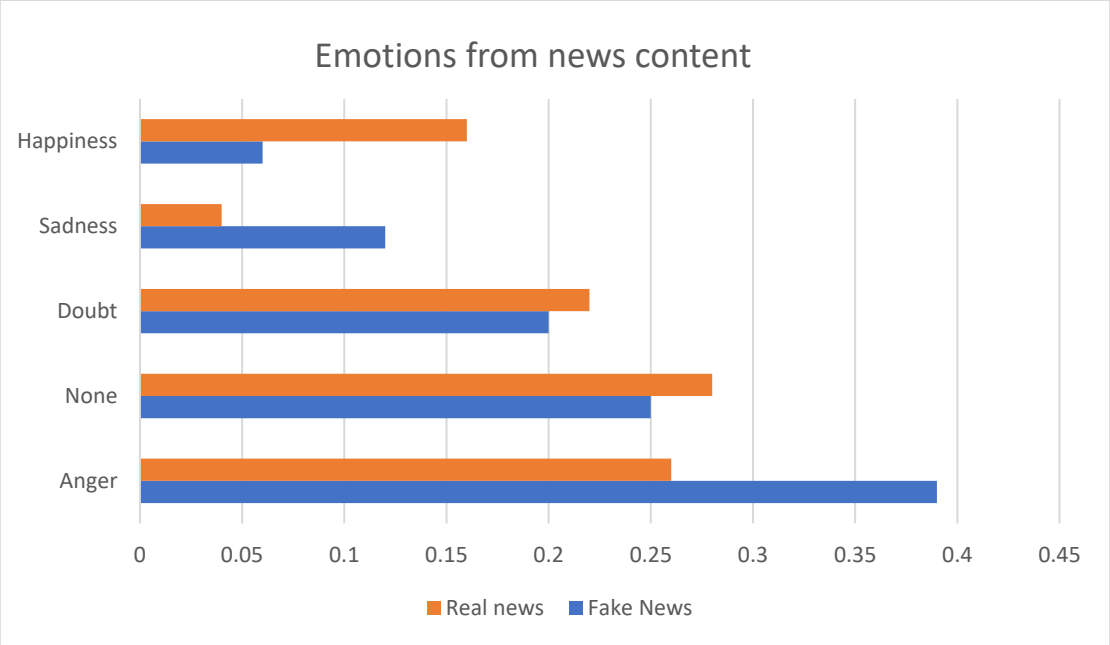

Figure 3.1 Distribution of human emotions when viewing news content (Zhang *et al.*, 2019).

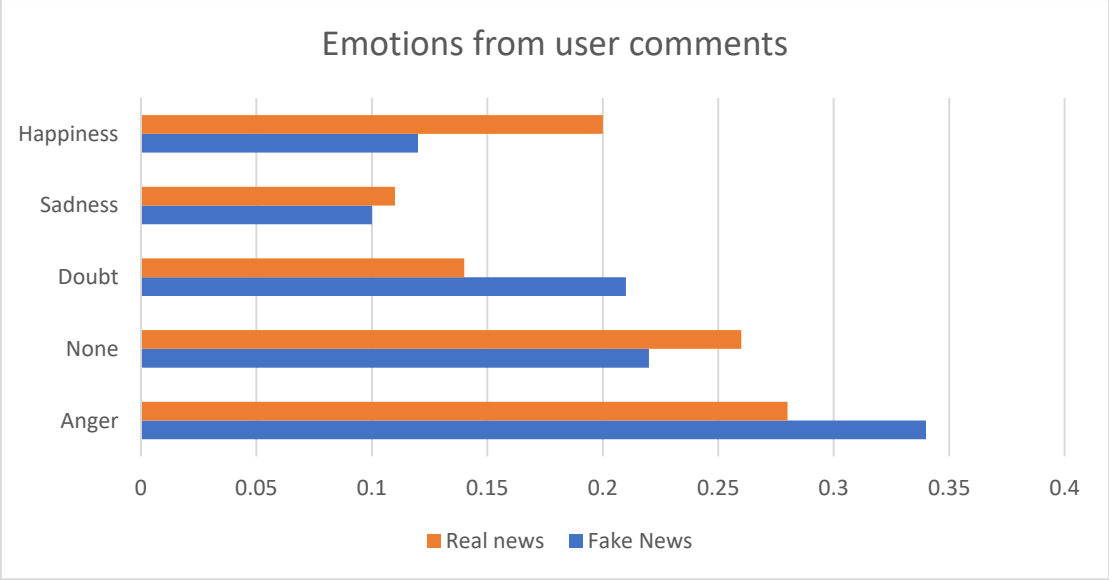

Figure 3.2 Distribution of human emotions when viewing user comments (Zhang *et al.*, 2019).

A study conducted by Itti and Baldi (2009) analysed how these emotions are used to attract attention to certain areas or posts. The study concluded that people are much more attracted to stories that would surprise the readers. Martel *et al*. (2020) argue that people are fooled by fake news, because they rely too heavily on emotions for decision making which leads to fake news being perceived as accurate.

3.4.3 Online trolling

Online trolling is the practice of behaving in a deceptive, destructive, or disruptive manner in a social setting on the Internet with no apparent instrumental purpose (Buckels *et al.*, 2014). There has been a great level of awareness brought to online pranksters with the rise of cyberbullying, but little empirical research exists on the effect that trolling has on the spread of fake news and misinformation.

The 2016 American presidential election presents a practical example of how online trolling was used to spread fake news. Russian troll accounts were created and would pretend to be news agencies during this presidential election period. The trolls would then post incorrect claims about the policies of the presidential candidates to benefit certain candidates. This act of trolling and fake news had a significant political, social and monetary impact (Jensen, 2018).

The combination of trolling and propaganda may have serious effects. Aro (2016) investigates how propaganda and trolling can be used as cyber warfare tools to take control of traditional news and social media. The study analyses how trolling can have an impact on freedom of speech and concluded that it should be viewed as a national security threat. In another example, Cabañes and Ong (2019) also analysed the impact of disinformation and trolling in

politics. They focused on how the “fake news factories” and the political trolling industry are used for organised social media manipulation around the world.

3.4.4 Questionable media practices

Questionable media practices are techniques used in media to appeal to more people and increase the popularity of their website or physical publication (Munger *et al.,* 2020*)*. Some media publications will use these techniques to get the most attention without considering the influence it might have on the public. Examples of these practices include clickbait, questionable authors, outdated news, as well as satire news.

Clickbait is one of the most popular techniques of recent years and involves the intentional use of exaggerated and misleading headlines to entice people to view a web page (Zhang & Clough, 2020). News articles accomplish this by using an outrageous headline in an effort to get people to view the article. Many users only view the headlines and share it, without reading the article or doing any research on the matter, cementing their opinion on the matter without any reliable information (Graves, 2016). Zang and Clough (2020) analysed around 30 000 fake and real Chinese social media news articles and showed that about 70% of these articles could be regarded as clickbait, showing how popular the technique has become.

Questionable authors are also part of questionable media practices. One prominent example of a controversial figure making controversial claims about the COVID-19 virus pandemic is Didier Raoult, a French physician, who recommended Hydroxychloroquine Sulphate and Azithromycin to combat the COVID-19 virus (Sayare, 2020). Although the recommended medicine was not fit for the treatment of the virus, many news publications would still share Raoult’s story and even the former president of the United States, President Donald Trump, would reference the French physician. This led to many people seeking to buy Hydroxychloroquine Sulphate and Azithromycin to treat COVID-19.

Some fake news stories are old news stories that have been slightly rewritten or just reposted in order to manipulate people into believing them again (Rogers, 2019). These stories may even find greater success, because its narrative is more supported than before. People will often share old news articles, thinking they are relevant today, without realising that the content posted is outdated (Kormelink & Meijer, 2014). As an example, a story of police corruption was circulating on social media in Canada, leading to many users criticising the Canadian Prime Minister. It was later found that the story being referenced was more than four years old and an investigation into the corruption was already conducted (Rogers, 2019).

Satire news is news that makes fun of current events and news, but which is portrayed as conventional news. The problem with satire news is that many users can be fooled by these

news articles; however, with some research, it can clearly be identified as fake (Kormelink & Meijer, 2014). Satire news accounts commonly use techniques discussed previously, such as clickbait and outdated information to create satire news. A site, such as *the Onion*[1] has been one of the most popular satire news sites in the world and has fooled many unaware users into thinking that their news is credible (Berkowitz & Schwartz, 2015).

3.5 The impact of fake news

Fake news has a considerable impact on individuals, companies and communities and is the subject of many research studies. Examples of such studies and the various ways of impacting people and their activities include the impact on personal beliefs (Chen & Cheng, 2019), fake news used to incite fear (McGonagle, 2017), how fake news affects democratic referendums (Guess *et al.*, 2018), endangering of groups of people (Fink, 2018), and the effect on the profitability of a company (Boulland *et al.*, 2017). In this section, the impact of fake news on individuals, companies and communities will be briefly introduced.

3.5.1 Individuals

The spread and exposure to misinformation normally has a significant impact on an individual. Brewer *et al*. (2013) stated that the impact is so comprehensive that it may influence a person's knowledge and opinion, as well as beliefs and trust, such as political trust. In a more recent study, Chen and Cheng (2019) analysed how fake news on social media can influence individuals' trust in certain brands. Their findings showed that fake news significantly influenced consumers' trust in brands and how they felt about companies. The change in beliefs and trust is also confirmed in a study by Leyva and Becket (2020) who argued that fake news changes the political beliefs and personal relationships of people.

3.5.2 Companies

Fake news also has the ability to have a significant influence on companies and especially the stock markets. For example, if a fake post from an unknown source goes viral on a social media platform, it has the potential to have a real-world effect on a company's stock price or image (Boulland *et al.*, 2017). A practical example of these effects was observed during 2013 when a small pharmaceutical company called Galena Biopharma in California was able to artificially inflate its stock market price with the help of fake news. The company paid for positive news articles to be strategically placed on online news outlets, such as Forbes (Parsons, 2020). This inflated their stock price from $2 a share to around $7 a share. The company then sold around 100 000 shares to make approximately $555 000.

[1] https://www.theonion.com/

Another example occurred when well-known automotive company, Tesla, was impacted by fake news in a negative way, causing its stock prices to plummet. A video posted online showed what seemed to be a Tesla autonomous driving car, crashing into a robot at a convention in 2019. Tesla's stock prices opened the day at $341.96 per share, but then hit a low of $321.01 in the middle of the trading day before closing at a price of $335.35. This drop could have been substantially worse, if Tesla did not respond quickly, or if the video could not have been proven to have been fake (Parsons, 2020).

Other examples of the impact of misinformation and fake news on companies and organisations can be found in Petratos (2021), Onete *et al*. (2020), and Visentin *et al*. (2019). The study by Visentin *et al*. (2019) focuses on how fake news can impact the behaviour of clients to certain brands and highlighted the growing risk of fake news for companies, as well as the significant implications for the reputations of companies. Petratos (2021) highlighted the potential risks of fake news to health care, media and financial markets and offers recommendations on how to respond to these risks and challenges. Finally, Onete *et al*. (2020) studied if professionals in the real estate business were aware of how fake news could affect their businesses and what the possible solutions might be.

3.5.3 Communities

The impact of fake news is not limited to individuals and companies, but widespread distribution of fake news can also have a significant impact on the well-being of communities. Gradoń (2020) states that misinformation may lead to unrest and panic, thereby forcing communities to use law enforcement and other valuable resources to mitigate the effects. An example of how communities are influenced occurred during the global outbreak of the COVID-19 virus. Social media platforms were used to share misinformation, claiming that new 5G cell towers were responsible for the outbreak. These fake news posts were shared hundreds of thousands of times on social media (Shultz, 2020) and resulted in widespread attacks on cell phone towers in the United Kingdom. This forced Vodafone to issue a statement condemning the attacks and false information (Fildes, 2020).

In another case, a South African rural community in KwaZulu-Natal received false information via social media that the government's COVID-19 testing programme was being used to spread the virus. The community refused to be tested for the virus and blamed the government for the rise of COVID-19 cases in their community (Fourie, 2020). To protect communities against fake news, the South African government instated a new law in South Africa (which could lead to a fine, six months imprisonment or both) for spreading fake news about the Corona virus (Truter, 2020).

3.6 Combatting fake news

From the discussion above, it is clear that fake news and the spread of misinformation have a serious impact and that it is something that needs to be addressed in every possible way. Many countries have already started implementing various laws, task forces, awareness campaigns and other strategies to combat the growing problem of fake news. Social media companies are also being pressurised to improve their platforms to stop the spread of misinformation, while there is a growing need to educate users of social media on how to identify and report fake news. In this section, some of the measurements implemented by various countries and social media companies will be highlighted. Brief mention of different community projects and tools used to combat fake news will also be made.

3.6.1 International reaction

Different countries have already employed different strategies, laws, regulations and community projects to combat fake news. Examples of these implementations are given below.

In Australia a “Stop and Consider” campaign was launched to encourage people to identify misleading information (Funke & Flamini, 2020), while Canada implemented a media literacy campaign and a government task force to combat the spread of fake news (Funke & Flamini, 2020). In Europe, countries such as Belgium and Germany focused on the education of residents, as well as enacting laws to prevent the spread of fake news on social media platforms (Echikson & Knodt, 2018). Other government acts, such as the NetzDG law in Germany focuses on stopping the spread of hate speech and fake news by forcing social media companies to monitor the content of their country (Claussen, 2018).

Asian countries also employed various strategies in the fight against fake news which would differ regarding each political and legal standard (Sherstoboeva & Pavlenko, 2020). Countries like China implemented strict laws that lead to imprisonment without any regard for freedom of expression (Sherstoboeva & Pavlenko, 2020), while India is actively researching and creating legislation to prosecute offenders who publish misinformation (Rydzak, 2019). In an effort to stop the spread of fake news, the Indonesian government blocked access to social media platforms (Potkin, 2019). A study by Cheng *et al*. (2020) found that less democratic Asian countries would be more in favour of strict regulations to stop fake news even if it could harm freedom of expression. Others would rather employ less strict measures, such as fact-checking web sites.

3.6.2 Community-driven projects

Community-driven projects are projects where communities prepare project proposals with the support of facilitators. They utilise investments from businesses and governments to finance their projects and are then responsible for the implementation and maintenance of those projects (Chase & Labonne, 2011). According to Heldt (2019), social media and the use of technology is not sufficient to moderate fake news, as companies are not swiftly responding with new developments to new laws and regulations. This makes the use of community projects a much more valuable and effective alternative to educate people on how to identify misinformation posts on social media (Echikson & Knodt, 2018).

Public awareness campaigns, such as the *#ThinkB4UClick* and *#defyhatenow* have been used to inform the residents of South Sudan to the dangers of misinformation, fake news and hate speech. The movements have recruited many partners, helping them to try and educate communities regarding the dangers of fake news (O'Neill, 2010). The campaigns also formed one of the main vocal points at the European Cyber Security Month campaign. The objective of this initiative was to raise awareness of cybersecurity threats and to try and promote better cyber-security practices amongst the public (European Commission, 2020). Results have shown that better education can be effective in helping to stop the dangerous spread of misinformation and individuals who participated in the campaign were able to correctly identify fake news and to report the posts to the social media companies, allowing the companies to stop the spread of misinformation.

3.6.3 Social media

Social media is the most significant platform that is used to spread fake news. It is therefore fair to expect social media companies to develop new ways to combat fake news and to protect their users from misinformation (Losifidis & Nicoli, 2020). Some of the more prominent social media applications that have implemented fake news measures include Google, Twitter, WhatsApp and Facebook. In 2020, Google blocked over 17 million scam emails and 240 million messages trying to capitalise on the Corona virus pandemic (Sonnemaker, 2020). In addition, a statement was issued by Google to warn its users about potential misinformation used to scam its users during the worldwide COVID-19 pandemic in 2020. The scams included hackers impersonating public health authorities, such as the World Health Organisation, asking for donations or contributions to infected countries, as well as asking users for their banking details to deposit money into their accounts to help families having financial difficulties. Additional proactive monitoring has also been implemented by Google to identify other similar scam emails (Sonnemaker, 2020).

The social media site, Twitter, released a statement to its users in which they explained that they plan to implement a new UI design. The new UI would leave warning messages on posts that seemed misleading, hoping to stop the misinformation the post was spreading. Misleading tweets by politicians and public figures would be marked with bright red and orange labels. By doing this, Twitter hopes to expand its commitment of the company's policy for moderating specific kinds of misinformation, such as deepfakes and conspiracy theories (Roth & Pickles, 2020).

WhatsApp Messenger is one of the most popular cross-platform messaging applications owned by Facebook and is regularly used to spread misinformation. An example of how the application may be used to promote false information can be found during the election in India in 2014 where supporters of political parties utilised the application to distribute false information for political gain (Kalra, 2018). To address these, and other similar fake news messages, WhatsApp limited the number of messages an account could forward, hoping it would stop the spread of misinformation (Hern, 2020).

Despite the success of the misinformation countermeasures, some of the measures implemented by social media companies were not as efficient as expected. Facebook, for example, used fake news detection software called anti-spam bots to detect fake news and to delete these fake messages before they could cause damage. However, these anti-spam bots also deleted news articles reporting on the Corona virus from credited sources. The reason was that there was such a huge volume of Corona virus fake news being reported that the anti-spam bots identified any post related to the Corona virus as misinformation (Price, 2020).

3.6.4 Fact-checking

Fact-checking is the act of verifying information to determine if the information is reliable and is one of the most important factors in combatting fake news (Graves, 2016). The fact-checking web sites are dedicated to report only on content that has been checked for reliability. Fact-checking web sites have also developed specific tools and plug-ins that will warn users of false information. This helps them to identify any false information, half-truths or news that is exaggerated (Hassan *et al*., 2015).

Social media companies also make use of different certified third-party fact-checkers to fact-check the content on their platforms (Graves, 2016). A study by Chung and Kim (2020) showed that when fake news on social media is debunked by fact-checkers, it would be much less likely to fool readers. Zhang *et al.* (2021) also analysed whether fact-checking could assist in stopping the spread of misinformation about the COVID-19 vaccine. They reported that the use of a warning label identifying a post about vaccines as misinformation would make viewers more positive towards vaccines. In addition, they also state that with the identification of

misinformation becoming more automated with machine learning, fact-checking could be the most cost-effective way to address misinformation.

3.7 Related literature studies

Fake news has been a popular topic over recent years and has produced many literature studies. In this section, some of these literature studies will be discussed and referenced to give an overall view of the impact of fake news and how it can be combatted.

Due to the serious consequences of fake news and the spreading of misinformation, several studies have been conducted with the aim of better understanding the effect that fake news can have on demographics, culture and personalities. In this section, examples of literature studies related to fake news will be briefly introduced.

A study conducted by Rampersad and Althiyabi (2019) investigates the relationship between demographic details and the acceptance of fake news. The results showed a weak relationship and that age plays a more important role in accepting fake news. A study by Bastick (2021) also identifies that certain personality types, such as people who use an intuitive reasoning style, tend to believe fake news more often than those with other personality types. The belief in, or acceptance of fake news, was also studied by Anthony and Moulding (2019). The results of this study showed that a person's political viewpoint, along with a conspiratorial worldview, would often lead to a greater belief in certain fake news.

Understanding which groups are more susceptible to fake news is an important part of combatting the spread of fake news. Loos and Nijenhuis (2020) suggest that older individuals over the age of 65 lack the skills to determine the authenticity of online news. Guess *et al.* (2019) believe this is due to reasons such as bad memory, memory loss and inexperience with digital media literacy. Other studies indicate that individuals between the ages of 15-30 have a higher risk of viewing fake news on a daily basis, because they tend to use social media as their main news source (Manalu *et al*., 2018). Because students tend to use social media as their primary source of news (Leeder, 2019), this study will focus on their fake news awareness levels.

Performing surveys and assessments of people's awareness and opinions on fake news is an important area of study and various research projects on this topic have been completed. A survey study by Porter *et al.* (2018) exposed 2 742 students to multiple examples of fake news on different types of media, such as internet message boards and videos. The students were then asked if they agreed with the contents of the stories presented to them. The study concluded that students tend to believe fake news if it benefitted their own ideological viewpoints. Nielsen and Graves (2017) also conducted a survey amongst online news readers.

Although the survey covered a wider range of topics, it also included specific questions focussing on fake news. The survey showed that the respondents blamed poor journalism and political agendas for the rise of fake news, but still trusted certain trustworthy news outlets. Most are sceptical of the news and are quick to judge certain news coming from untrustworthy news sources.

Another survey amongst university students by Zakharov *et al.* (2019) analyses 108 students in an effort to understand their perception of fake news in terms of content, purpose and source. The results of the survey showed that students would primarily seek news from traditional sources. The students would view these news sources from their phones and social media sites. An important study on how students evaluate and share fake news was performed by Leeder (2019). Leeder surveyed 63 undergraduate students where they identified and evaluated fake and real news articles. Their behaviours when viewing and identifying fake and real news were recorded. The results showed a strong correlation between accurate identification of fake news stories when the students made use of certain strategies. Certain other behaviours also help students accurately identify news stories as either fake or real news. Students would also not take into account how trustworthy and reliable news stories were when deciding if they wanted to share a news story on social media. Leeder's study helps to better understand the decision process of students when deciding whether to share certain news stories to friends and family and their behaviours when coming into contact with fake news.

Waszak *et al.* (2018) analysed top-shared news from social media to see how the spread of medical fake news could endanger communities. The study used an application to analyse the top-shared health web links on social media in Poland and found that more than 40% of the most frequently shared links contained fake news and that these links were shared more than 450 000 times.

Combatting fake news is an important area of study and several research studies have been conducted in this area. Some of the examples include how educating social media users can significantly increases the likelihood of correctly identifying fake news and misinformation (Jones-Jang *et al*., 2019). The need for increased fake news awareness and information literacy among users is confirmed by a study performed by Aspuke and Omar (2020) who analysed and highlighted problems, such as death, conflict escalation, political hostility and societal panic as a result of fake news. Awareness, according to this study, may be raised by advertisements, workshops, conferences, etc.

Apart from awareness campaigns, Yamaoka-Enkerlin (2020) argues that technical, regulatory and other educational solutions may also help with the spread of misinformation. The study

also pointed out that companies may find it difficult to disclaim social responsibility or to escape scrutiny when faced with fake news.

Deepak and Chitturi (2020) investigated a neural network to identify fake news. Human beings find it difficult to decide on the authenticity of an article without doing additional research and with the amount of news being shared online, automation of the process is needed. They discuss a deep learning model that mimics the fact-checking process of checking source domains of the article, author names and dates published. Other studies by Salazar (2020) and Guerzhoy *et al*. (2019) also investigate how artificial intelligence can play an important role in identifying and combatting fake news.

Newly developed blockchain technologies are being used to combat fake news. Blockchain could provide a transparent, immutable and verifiable record of transactions while creating a peer-to-peer secure platform for storing and exchanging information. These new technologies are analysed and explained by Fernández-Caramès and Fraga-Lamas (2019). They gave an overview of the potential of blockchain technologies that can be used to combat digital deception and reviewed other initiatives currently under development. Other studies by Lacity (2021) and Huckle (2017) investigate how these blockchain technologies can be used to combat digital deception.

Deepfakes are a recent, popular way too spread misinformation. The quality of deepfakes has increased significantly in recent years, which makes it difficult to identify if a photo or video may have been edited. These edited videos and photos can easily be used to fool unsuspecting social media users. Bateman (2020) published a study highlighting the threat deepfakes and other synthetic, AI-generated media has. He identified specific ways that deepfakes and other synthetic media could facilitate financial harm, giving an overview of how often they could happen and possible solutions to the problem. Different scenarios targeting individuals, companies and the financial markets are presented and analysed to better understand what problems could occur. Botha and Pieterse (2020) summarised the current state of fake news and deepfakes. They warn of the dangerous threats fake news and deepfakes could have in respect of information security in the 21st century. Their paper also reviewed current tools and detection techniques used to identify fake news and deepfakes. A study by Chesney and Citron (2019) investigated how deepfakes could be used for political manipulation and gain. Deepfakes could be used by insurgent groups and terrorist organisations to incite panic and gather more supporters. Their study also discusses how Russian social media accounts have posted inflammatory content purposely designed to stoke racial tensions in the past. Other studies by Wagner and Blewer (2019), Greengard (2019)

and Schick (2020) discuss the dangers of deepfakes and how they can be used to influence people's opinions and ideas.

Examples of other studies addressing the dangers of fake news and how to combat them are presented in Table 3.1.

Table 3.1 Additional literature examples.

Authors	**Year**	**Title**
Ahmed, W., Vidal-Alaball, J., Downing, J., Lopez Seguí, F.	2020	Dangerous messages or satire? Analysing the conspiracy theory linking 5G to COVID-19 through social network analysis.
Barrera, O., Guriev, S., Henry, E., Zhuravskaya, E.	2020	Facts, alternative facts, and fact checking in times of post-truth politics.
Butler, A.	2018	Protecting the democratic role of the press: A legal solution to fake news.
Deepak, S., Chitturi, B.	2020	Deep neural approach to fake-news identification.
Downing, J., Ahmed, W., Vidal-Alaball, J., Segui, F.L.	2020	Battling fake news and (in)security during COVID-19.
Tandoc, E.C., Lim, Z.W., Ling, R.	2017	Defining "fake news".
Gaozhao, D.	2021	Flagging fake news on social media: An experimental study of media consumers' identification of fake news.
Haciyakupoglu, G., Yang, J., Suguna, V.S., Leong, D., Rahman, M.	2018	Countering fake news: A survey of recent global initiatives.
Kogan, S., Moskowitz, T.J., Niessner, M.	2018	Social media and financial news manipulation.
Marwick, A.	2018	Why do people share fake news? A sociotechnical model of media effects Font?
Nagi, K.	2018	New social media and impact of fake news on society.
Rodríguez-Fernández, L.	2019	Disinformation and organizational communication: A study of the impact of fake news.

Sullivan, M.	2019	Libraries and fake news: What's the problem? What's the plan?
Verstraete, M., Bambauer, D.E., Bambauer, J.R.	2017	Identifying and countering fake news.
Visentin, M., Pizzi, G., Pichierri, M.	2019	Fake news, real problems for brands: The impact of content truthfulness and source credibility on consumers' behavioural intentions toward the advertised brands.

All the studies listed above highlight the dangers of fake news and how everyday users of social media are exposed to these dangers. The studies also focus on how social media has become the perfect tool to spread false news and reach a wider audience. The research studies argue that there is a need for better technology to be developed to identify fake news and help educate the public on how to identify fake news on social media.

3.8 Summary

In Chapter 3, an overview of the context and important concepts associated with fake news was presented. Aspects, such as the motives and methods of spreading fake news, as well as the impact of fake news were discussed. Different techniques and strategies to combat fake news were also presented. The chapter was concluded with an overview of related literature studies on fake news. In the next chapter, the development of a fake news awareness measuring instrument, as well as a pilot study to validate the questionnaire will be discussed.

Chapter 4: Development of a measuring instrument

4.1 Introduction

In the previous chapters, context to the study is provided, presenting the problem statement and an overview of fake news and its dangers. In Chapter 2, in particular, the research method that is followed in this study is detailed and the methodological aspects of the development of measuring instruments are also highlighted. In these preceding chapters, the first two phases of the design science framework followed in this study are addressed; i.e., the awareness of the problem phase (Chapter 1 and Chapter 3) and the suggestion phase (Chapter 2). In this chapter, the focus will be on the third phase of the design science framework, namely the development phase. The actual development and testing of the measuring instrument used to perform a fake news opinion and awareness survey amongst students is described. The goal in this chapter is therefore to present a discussion on the questionnaire, the sources of the questions and the results of a pilot study performed to assess the adequacy of the survey instrument.

4.2 Developing the questionnaire

As explained earlier, the primary data collection method used in this study is by making use of a questionnaire. A general discussion of questionnaires as data collection instrument was also presented in Chapter 2 and will not be repeated here. Aspects that were discussed in Chapter 2 and that are relevant here, include, amongst others, question types, general guidelines for developing a questionnaire, advantages of questionnaires, administering questionnaires, etc.

In this section, an explanation and motivation of the various questions, the sampling method used, and how the questionnaire was administered will be offered.

4.2.1 Questions used in the survey instrument

The success of the study is dependent on the survey and subsequent data collection and analysis process. The development of the questionnaire is therefore vital and a structured manner of planning and constructing the instrument was followed. As an initial step, the objective of the questionnaire was formulated as follows: To develop and implement an effective measuring instrument, based on scientific guidelines (as outlined in Chapter 2), that can be used to determine the level of fake news awareness amongst a random group of university students.

Once the objective of the measuring instrument was determined, the next step was to decide which sources to use to formulate and motivate the inclusion of specific questions. To ensure

that questions are valid and well justified, a mix of existing literature, previously conducted surveys and other related awareness campaigns were used as sources for the various questions.

Following the identification of possible questions from the literature, the next step entails a decision on the types of question; i.e., open-ended questions, multiple-choice questions, dichotomous questions, etc. To assist with this task, the list of guidelines suggested by Artino *et al*. (2014) was also adhered to where appropriate. The guidelines are presented again in Table 4.1 for completeness' sake.

Table 4.1 Question development guidelines (Artino et al., 2014).

Simple guidelines to ensure that the basic requirements of the questionnaire are covered
Use short and simple sentences.
Ask for only one piece of information at a time.
Avoid negatives if possible. An example of the formulation of a negative question is as follows: In the last 24 hours, how many times did you not use social media?
Ask precise questions.
Avoid unnecessary details, as people are usually less inclined to complete long questionnaires. However, ask for all the essential information.
Avoid using statements instead of questions.
Avoid using agreement response anchors.
Avoid using too few or too many response choices. Use five or more response choices when making use of a Likert scale system.

The final step is to construct the questionnaire taking the above evaluation and decisions into account. The complete questionnaire, which comprises three main sections and a total of 25 questions, is presented in Appendix A. The three sections of the questionnaire are further described below.

Section A consists of four questions and is used to obtain demographic details of the participants. These details are necessary to understand certain background characteristics of the respondents and will provide information on whether there is an under- or over-representation of certain groups. Demographic data is also used during data analysis to

determine whether significant differences between demographical groups exist. The four demographic variables are age, gender, field of study (i.e., BCom) and faculty (i.e., Natural Sciences).

Section B consists of eleven questions. The aim of this section is to obtain information regarding respondents' news preferences, general behaviour with regard to news articles, and opinions related to certain aspects of news and news platforms. The question types include four multiple-choice questions where a respondent may select more than one option if appropriate. There is one simple dichotomous question which requires a yes or a no answer and six rating (Likert-type) questions which are answered on a scale of 1 to 5.

Below are examples of each of the three types of question used in Section B (the complete questionnaire is available in Appendix A).

Example of a multiple-choice question

"Which social media applications do you use for reading the news? (Tick all that apply)"

Available responses include Facebook, Snapchat, YouTube, Instagram, Twitter, Reddit, LinkedIn, Pinterest, Tumblr, TikTok, WhatsApp, Telegram. Respondents may choose all the relevant options and are also given the opportunity to add any other social media application that is not included in the list.

Example of a dichotomous question

"Are you aware of the fact-checking movement in journalism, which includes web sites, such as PolitiFact, Factcheck.org, and the Washington Post Fact Checker?"

A simple yes or no response is required.

Example of a rating (Likert-type) question:

"How often do you make use of fact-checking web sites to verify information that you have received or read?"

Available response on a 1 to 5 Likert scale include: Never, Rarely, Only when I doubt the information, Sometimes, and Always.

As referred to earlier, the questions and formulation were based on literature resources, as well as existing questionnaires. Table 4.2 below shows the objective of each of the eleven questions in Section B, as well as the literature source that was used as a motivation or justification for the question. Please refer to Appendix A for the eleven questions mentioned in Table 4.2.

Table 4.2 Section B questions - Literature resources.

Question number (See Appendix A)	Objective of question	Literature resource
1	To identify the most important news sources commonly used by respondents.	Leeder (2019).
2	To identify social media applications most used by respondents – these are the applications that are typically targeted with fake news.	Head *et al*. (2019) Leeder (2019)
3	To identify whether respondents are aware of any fact-checking assistance. Previous research indicated that people are generally unaware of fact-checking tools and as a result are more susceptible to fake news.	Guess *et al*. (2018) Hussain *et al*. (2019)
4	To help identify opportunities to educate respondents how to identify fake news.	Guess *et al*. (2018) Hussain *et al*. (2019)
5	To determine if respondents check or verify news sources. Previous studies concluded that crosschecking of news sources significantly lowers the spread of fake news.	Guess *et al*. (2020) Head *et al*. (2019)
6	Misleading and attractive headlines are often used to attract new viewers. These headlines are often grossly overdramatised and may lead to readers making conclusions without reading the article. The objective is to determine whether participants are influenced by overdramatised headlines.	Farmer (2019)
7	Many news articles are shared with outdated information and with dramatic footage that may have happened long ago. These stories get re-shared and the news may then garner more support than when it was previously posted. The objective is to	Head *et al*. (2019) Hussain *et al*. (2019)

	determine whether participants verify news articles of recent news.	
8	To verify if respondents crosscheck news articles with other media outlets.	Moneva *et al*. (2020)
9	To determine whether respondents consult experts to understand information that is difficult to interpret – consulting an expert may help identify fake news.	Head *et al*. (2019) Hussain *et al*. (2019)
10	The question relates to the spreading of fake news and the aim is to determine whether respondents share specific topics in news articles with others.	Hussain *et al*. (2019) Leeder (2019)
11	To understand why respondents share news articles.	Roozenbeek and Van der Linden (2019)

Section C of the questionnaire consists of ten questions and aims to evaluate a respondent's knowledge regarding fake news. Each question contains either a real or a fake news story. Respondents are then asked (dichotomous question) to identify whether each of the news stories is a fake news story or whether it is real. Responses are given as a yes (real story) or a no (fake story) answer. Furthermore, a series of sub-questions pertaining to each of the news stories is also asked. Respondents have to explain (open question) how they came to the conclusion of a fake or real story. Finally, participants are asked to indicate on a 4-point scale how believable and trustworthy they believe each news article is.

As explained in Chapter 2, the definitions offered by Gelfert (2018) and Allcott and Gentzkow (2017) were used to select fake news articles for identification by respondents. For completeness' sake, the definitions are quoted again:

"Fake news, ……, is best defined as the deliberate presentation of (typically) false or misleading claims as news, where the claims are misleading by design." (Gelfert, 2018:86).

"We define 'fake news' to be news articles that are intentionally and verifiably false, and could mislead readers." (Allcott and Gentzkow, 2017:213)

The ten selected news articles, of which six were fake and four were real, were sourced from a variety of social platforms and includes the following: one post from Instagram, one post from Facebook, three news articles from general news platforms, one video from YouTube,

one video from TikTok, one tweet from Twitter, and two videos from Twitter. An example of a news article used in Section C is presented below (complete questionnaire is presented in Appendix A).

A news article about a woman getting life in prison for murder witnessed by a parrot.

Figure 4.1 News headline for the question.

The above news article was reported by the New York Post where the odd circumstances of calling a parrot as a witness to a murder case were described. This is probably a hard to believe news article, which may also be viewed as satire, although it is a real news story.

A summary of the fake and real news articles, together with the sources to validate the claims made in the articles, is presented in Table 4.3.

Table 4.3 News article sources.

News article (See Appendix A)	**Fake/Real news**	**News article source**
1	Fake	A fake news article that has been fact checked by PolitiFact. https://www.politifact.com/factchecks/2021/may/10/instagram-posts/no-death-rate-vaccinated-people-not-higher-unvacci/
2	Fake	A fake news article. The Red Cross has confirmed that it is fake news.

		https://www.redcrossblood.org/local-homepage/news/article/covid-19-vaccination-guide-blood-donation.html
3	Real	A real news article that has been confirmed as real by various news sites, such as the CNBC. CNBC: https://www.cnbc.com/2021/04/16/fukushima-japans-plan-to-dump-radioactive-water-is-not-dangerous-prof-says.html
4	Real	A real news article that has been confirmed as real by various news sites, such as Fox News. Fox News: https://www.foxnews.com/us/michigan-woman-gets-life-in-prison-for-murder-parrot-allegedly-witnessed
5	Real	A real news article. There is extensive research that shows marijuana can lead to psychotic disorders, such as schizophrenia, particularly if people start using it as children or teenagers. https://www.thelancet.com/action/showPdf?pii=S2215-0366%2819%2930048-3 https://www.cdc.gov/marijuana/nas/mental-health.html
6	Real	This news article was fact-checked by Africa Check. (Following the pilot test, this article was replaced in the final questionnaire). https://africacheck.org/fact-checks/reports/smoke-roughly-r35m-tobacco-tax-revenues-lost-daily-during-south-africas
7	Fake	National geographic and other news stories reported on this viral fake news. https://www.nationalgeographic.com/animals/article/coronavirus-pandemic-fake-animal-viral-social-media-posts
8	Fake	Was reported on the well-known fake news web site, the Onion. https://www.theonion.com/rory-mcilroy-attacked-by-mother-hawk-protecting-golf-ba-1846652360
9	Fake	A fake news article. Data from the World Health Organisation shows India recorded the highest number of women and girls killed due to interpersonal violence, at 13 093. South Africa was ranked ninth, with an estimated 3 444 deaths. This claim was also fact-checked my Africa Check. https://africacheck.org/fact-checks/reports/minister-zulu-wrong-south-africa-ranks-high-not-number-one-killing-women
10	Fake	A fake news article. Was fact-checked by Africa Check.

		https://africacheck.org/fact-checks/spotchecks/no-south-africas-late-zulu-king-zwelithini-didnt-get-r713-million-salary

This concludes the description of the process that was followed to determine and formulate the questions used in the questionnaire. The following sub-section will briefly highlight how the questionnaire was administered for the pilot test.

4.2.2 Sampling method

Sampling, which is succinctly defined as "*the process of choosing a part of the population to represent the whole*" (Naderifar *et al*., 2017), is an important step in the data collection life cycle. There are generally two ways to perform sampling; i.e., probability and non-probability sampling.

Probability sampling, also termed representative sampling, implies that the rules of probability are applied and each member of the population has an equal chance of being selected. Examples of probability sampling include the following (Saunders *et al*., 2009):

- simple random sampling – members or cases are numbered with unique numbers. A sample is then selected at random, using a random number generator or random number tables until the required sample size is reached.
- systematic sampling – select a sample at regular intervals.
- stratified sampling – the population is divided into a number of strata, depending on a number of attributes. A random sampling process is then used to select cases/members from each stratum.
- cluster sampling – the population is divided into discrete groups of clusters. Clusters are then selected (as opposed to individual cases) using a simple random sampling process.
- multi-stage sampling – is also referred to as multi-stage cluster sampling and involves taking a series of cluster samples.

Non-probability sampling refers to scenarios where not every member has an equal chance of being selected; i.e., the probability of being selected is unknown (Naderifar *et al*., 2017). Examples of non-probability sampling include the following (Saunders *et al*., 2009):

Quota sampling: normally used for interview surveys. The population is divided into specific groups and a quota is calculated for each group. An interviewer is then required to collect data from a specified number of members in each quota.

Purposive sampling: also referred to as judgmental sampling is a sampling process where the researcher's judgment is used to select cases or members. Respondents are selected which, according to the researcher's judgment, are best able to provide the required answers or information.

Convenience sampling: select those cases or members or individuals that are available and easily accessible.

Snowball sampling: is a convenience sampling method and refers to a scenario where it is difficult to access and/or identify members of a specific population. Existing (already identified) participants are used to recruit other participants.

Self-selection sampling: the need for participants is publicised (i.e., through advertising) and potential participants then volunteer to take part in a survey or research project. This is sometimes called voluntary response sampling.

In this study, a combination of probability and non-probability techniques were employed to identify participants to take part in the fake news awareness survey. This decision was based on the target population of university students and helped to ensure that a representative sample was obtained. The sampling process, which was used in both the pilot study and the actual survey, was structured as follows.

Step 1: Use a probability sampling technique, i.e., stratified sampling, to divide the target population into different appropriate strata. The population of university students was divided according to field of study into eight different strata. These eight strata were represented by the eight faculties of the university where the survey was conducted and include: the faculties of Economic and Management Sciences, Education, Engineering, Health Sciences, Humanities, Law, Natural and Agricultural Sciences and Theology.

Step 2: Once the different strata were identified, a non-probability sampling technique was employed to identify and select participants; i.e., the snowball sampling method. Even with a large number of students at a university campus available, it remains extremely difficult to identify participants that would be willing to take part in the survey. To overcome this problem, the snowball sampling technique, which is a convenience approach, was used to identify a small number of students in each stratum (faculty) and then asked to distribute the questionnaire to other students in their faculty with a request to complete the questionnaire. The four steps in this process are, according to Saunders *et al*. (2009), as follows:

- Make contact with one or two students in each stratum (faculty).
- Ask these students to identify and recruit other students within their faculty.
- Ask these new students to identify and recruit further students (and so on).

- Stop when either no new students are recruited or when the sample size is adequate.

A graphic depiction of how this sampling technique snowballs is presented in Figure 4.2.

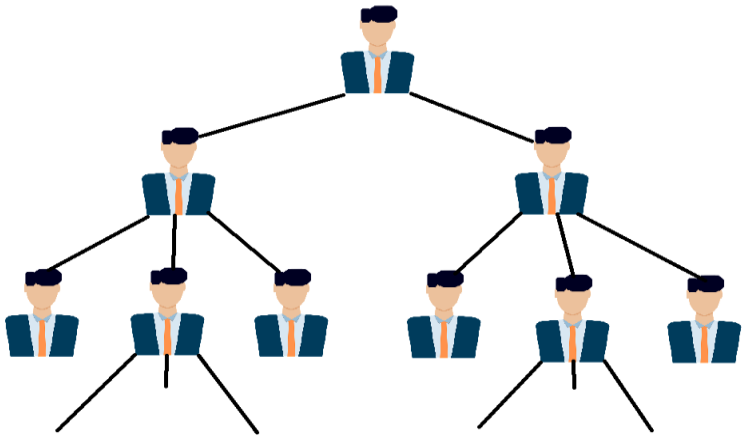

Figure 4.2 Snowball sampling technique.

To implement the snowball sampling approach, between two and five candidate participants in each of the faculties were identified and personally asked to distribute the survey to other students within their faculty. These newly identified students were then asked to distribute it further.

4.2.3 Administering the survey instrument

Questionnaires are usually administered as self-administered (completed by the respondents) or interviewer-administered (recorded by an interviewer) questionnaires (Saunders *et al*., 2009). The type of questionnaire used will vary, depending on the administering choice. Figure 4.3 shows the details of the classification of questionnaires:

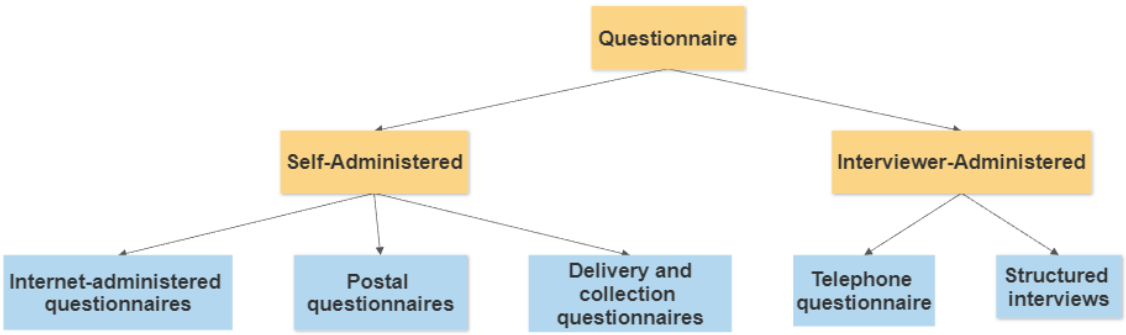

Figure 4.3 Questionnaire administering (Saunders *et al*., 2009).

In this study, the self-administered option was chosen and an Internet-mediated questionnaire (see Figure 4.3) was used. This means that the questionnaires are administered electronically, using the Internet. The distribution of the request to participate was done via an email message which contained a link to the actual questionnaire where participants could complete the survey. Responses were then electronically captured in a file and later retrieved for further analysis. The questionnaires were available for one week during the pilot study and two months during the actual survey.

The questionnaire (described in Section 4.2.1) was tested in a pilot study (described in the next section) to determine if there are any shortcomings. The above administering process was followed for both the pilot study and the final survey (described in Chapter 5).

4.3 Pilot study

A pilot study is designed and carried out to test various aspects before a larger, more rigorous investigation is conducted (Arain *et al*., 2010). The goal of the pilot study is not to answer the research question, but to prevent researchers from conducting a large-scale study without adequate knowledge of the methods proposed (Polit & Beck, 2017).

4.3.1 Participant demographics

Following the above self-administering process, a total of 21 students participated and successfully completed the Internet-mediated questionnaire for the pilot study. Participants were identified and invited to take part in the survey according to the snowball sampling method described in Section 4.2.2. The survey was available for one week and took approximately 10-30 minutes to complete. The age range of participants (see Figure 4.4) was 19 to 32 years, with a mean of 21.57 years. The gender distribution was 61.9% male and 38.1% female.

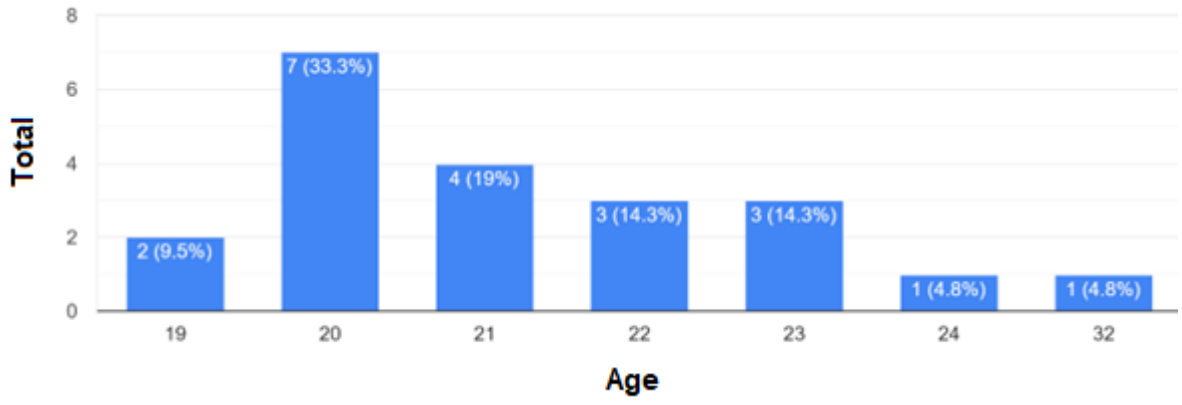

Figure 4.4 Age distribution of participants.

The pilot study respondents came from five different faculties and fields of study; i.e., Economic and Management Sciences (38.1%), Law (23.8%), Natural and Agricultural Sciences (14.3%), Education (14.3%), and Humanities (9.5%). The distribution is shown in Figure 4.5.

Figure 4.5 Faculty of the participants.

4.3.2 Results

The first aspects that were tested were reliability and validity. Due to the nature of the questions, it was decided not to make use of formal statistical measures, as it was expected that responses (opinions) may differ if the questionnaire was repeatedly administered to different respondents. Instead, it was decided to rather use the guidelines provided by McKenna *et al*. (2003) to test validity. The guidelines are presented as a series of five simple questions and were critically reviewed to ensure that the questionnaire complied with the necessary validity requirements. The questions and the evaluation are presented in Table 4.4 below.

Table 4.4 Validity guidelines (McKenna *et al*., 2003).

Guiding questions	Evaluation
1. Are the questions clear and easy?	Care was taken to ensure that questions were clear and easily understood. As explained earlier, the questions were based on literature sources and were deemed to be in line with other similar surveys.
2. Did the questions cover all the problem areas of this study?	Questions were based on literature sources and previous surveys and covered all relevant areas of the study. The questions were also aligned with the objectives of the

	study to ensure that all relevant areas were covered.
3. Would this questionnaire benefit other researchers for future assessments?	Results from the questionnaire will provide insight into the level of awareness of fake news amongst students. It is believed that these insights will benefit other researchers. In addition, the questionnaire itself (how it was structured, questions formulated, etc.) may serve as an example for future fake news surveys and studies.
4. Does the questionnaire lack important questions that could provide meaningful data?	The questions are in line with the objectives of the study and it is believed that all significant questions have been included in the questionnaire.
5. Do some of the questions violate the privacy of respondents?	Participants gave consent and were able to terminate participation at any time should they feel that questions violate their privacy. Responses were anonymous and no personal (privacy-related) questions were asked.

Following the critical review detailed in Table 4.4, the questionnaire was deemed valid and was made available to the pilot study participants. In addition to responding to the questions in the questionnaire, pilot study participants were also asked to evaluate the questionnaire in terms of length (is the questionnaire too long?), clarity (are questions clear?), and complexity (are fake news articles presented in the questionnaire too simple and too easy to identify?). Feedback was also solicited on how the questionnaire could be improved.

The results from the pilot study can be summarised as follows:

- 24% of the respondents indicated that the questionnaire should be improved. The suggested improvements were detailed in feedback related to length, clarity and complexity.
- ***Length***: All respondents were satisfied with the length of the questionnaire. It took on average 10-15 minutes to complete the questionnaire which was acceptable to all participants.
- ***Clarity***: Some of the ranking scales used in the questionnaire were reported as confusing. Participants also reported that the scoring system used in ranking questions

did not make intuitive sense and were therefore difficult to understand. One of the questions required participants to indicate which news articles they would share with friends. However, there was no option to indicate that no articles would be shared and participants were forced to answer, even if they do not share news articles.

- ***Complexity***: Only one respondent indicated that the news articles presented in the questionnaire were too easy to classify as fake or real. This respondent, however, only classified six out of the ten news articles correctly.
- ***Classification of news stories***: 55% of the fake news articles were correctly classified as fake news, while 67% of real news articles were classified as real news. The detailed classification results of all news articles are presented in Table 4.5.

Table 4.5 Classification of news articles during the pilot study.

News articles	Fake or Real news	Number of correct Identifications	Percentage of correct Identifications
1. Death rate for COVID-19	Fake	15	71%
2. Donating blood	Fake	16	76%
3. Japan dumping contaminated water	Real	16	76%
4. Parrot witnesses murder	Real	13	62%
5. Marijuana can increase risk of psychotic disorders	Real	12	57%
6. South Africa lost R34 million revenue	Real	16	76%
7. Dolphins returned to the canals in Venice	Fake	9	42%
8. Golfer attacked by a hawk	Fake	13	62%
9. South Africa is ranked number one in the murder of women	Fake	2	9%
10. South Africa's late Zulu King Goodwill Zwelithini received a R71.3 million annual salary	Fake	15	71%

The results of the pilot study were used to improve the questionnaire before the actual survey was conducted.

4.3.3 Improvements made to the questionnaire

Based on the feedback received and the results of the pilot study, the following improvements were implemented.

- Length of the questionnaire: No improvements were needed.
- Clarity: The ranking scale used in the questionnaire was changed. This change resulted in clearer questions and it was easier for respondents to understand what was required from the specific questions. Respondents were asked to rate the order of importance of primary news sources. A 5-point scoring system was used with 1 being the most important and 5 being the least important. However, respondents assigned a 5 if identified as “most important” and a 1 if identified as least important. The scoring was changed accordingly to accommodate the understanding of respondents. With regard to the question on the sharing of news articles, an additional option for “no sharing” was added.
- Complexity: To improve the complexity level of the questionnaire, one of the news articles was replaced with a more recent and more difficult to classify article. News article number 6 (South Africa lost R34 million revenue) – see Table 4.5, which was one of the most correctly identified news articles, was replaced with a news article on Durban metro police who (apparently) stole looted items during the July 2021 protests. It should be noted that this change also changed the total number of real news stories from four to three as the new news item was a fake news story.

The pilot study proved to be beneficial and offered an opportunity to ensure that the survey instrument complies with all the requirements. Shortcomings were identified and rectified prior to the actual survey. The improved questionnaire was then distributed to a larger audience and the result of this survey is presented in the following chapters.

4.4 Summary

In this chapter, details of the third phase of the design science framework, namely the development phase was presented. The actual development and testing of a fake news awareness measuring instrument for students were described. In the chapter, the development and question identification process, the sampling method used, and how the questionnaire was administered were detailed. Details of a pilot study and improvements to the questionnaire were also presented. In the next chapter, the results of the final survey will be presented.

Chapter 5: Fake news awareness survey

5.1 Introduction

In Chapter 5, to the focus is on phase three, the evaluation phase, of the design science framework that is used in the study. The measuring instrument that was developed and tested in Chapter 4 was applied to a sample of university students and the aim of this chapter is to report the results of the survey. Firstly, a description of how the survey was administered will be presented, followed by some demographic details of participants. The detailed results are then presented for each question in each of the questionnaire sections. Finally, some general and concluding remarks will be offered.

5.2 Administering the survey

The administering of the survey follows the same methodology used for the pilot study. A brief overview of the process will be given in this section, while a more detailed description can be found in Chapter 4.

As a first step, the target population was divided into eight different strata according to the eight faculties of the university where the study was performed (i.e., stratified sampling). The eight faculties (strata) are Economic and Management Sciences, Education, Engineering, Health Sciences, Humanities, Law, Natural and Agricultural Sciences and Theology. The next step was to recruit students to participate – this was done via a snowball sampling technique where a small number of students from each of the strata was asked to participate. They were then requested to recruit other students who were again requested to recruit other students, and so on.

At least five students from each faculty were contacted and asked if they would participate in the survey and if they would be willing to recruit other students to also participate. The process produced a total of 191 participants of which 183 responses were usable. The sample size of 183 students was deemed appropriate and compared favourably with similar studies in the literature. For example, the study by Leeder (2019) had a sample size of 63.

The self-administered option was used to administer the survey. This option makes use of an Internet-mediated questionnaire; i.e., the questionnaire was distributed electronically via email messages that contain a link to the questionnaire. The questionnaire was available for two months to complete and responses were also captured electronically.

5.3 Demographic details of participants

As mentioned in the previous section, 183 usable responses were obtained. The age range of participants was 18 to 45 with a mean age of 22.7 and a mode of 20 years. Figure 5.1 shows

the age distribution. The gender distribution was 66.1% (121) male and 32.2% (59) female while 1.6% (3) of the participants preferred not to answer the gender question.

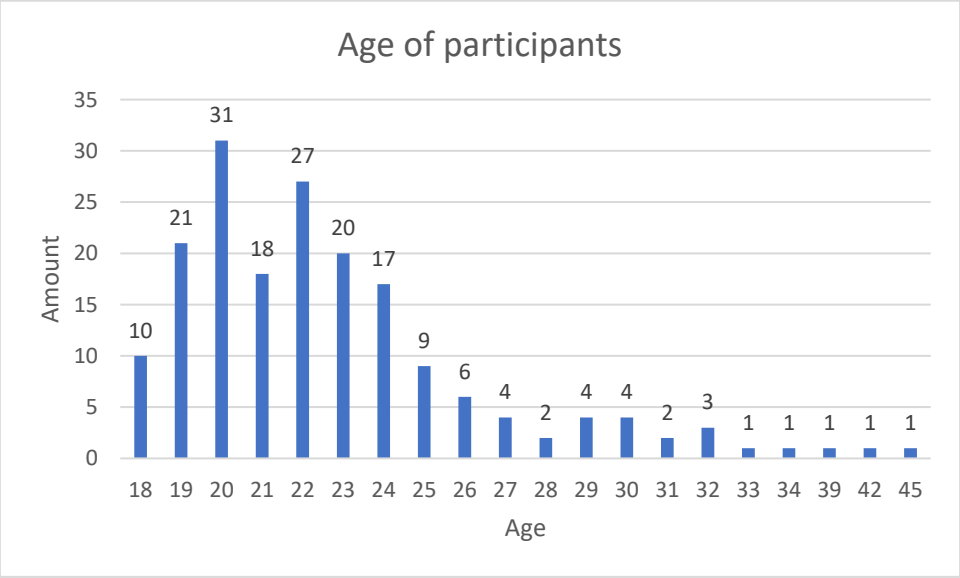

Figure 5.1 Age distribution of participants.

There were no participants from the faculty of Theology. The distribution of the participants from the other faculties is as follows (see also Fig 5.2): Natural and Agricultural Sciences (25.1%), Economic and Management Sciences (20.8%), Engineering (14.8%), Education (13.7%), Health Sciences (10.9%), Humanities (10.9%) and Law (3.8%),

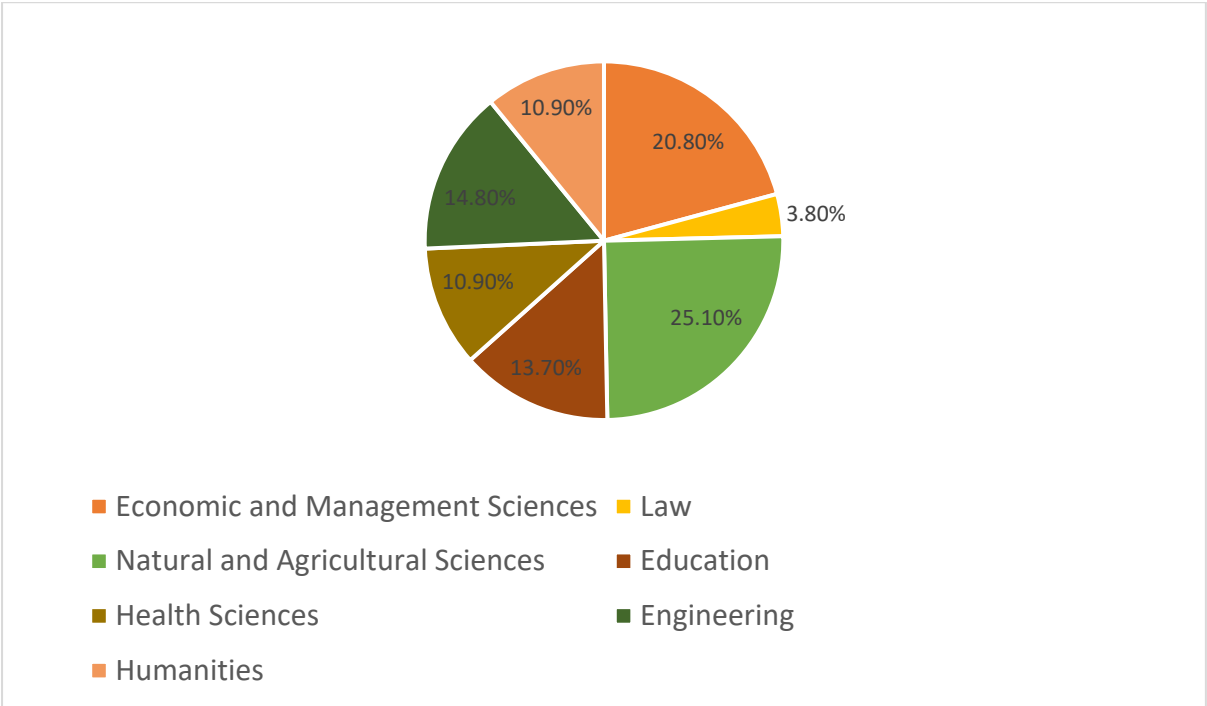

Figure 5.2 Participant distribution over the faculties.

The results of the survey will be presented in the next section.

5.4 Results of the survey

Section A of the questionnaire consists of demographic details which were already presented in the preceding section. The remaining results of the other sections in the questionnaire will be presented per question for each of the sections in the subsequent sub-sections.

5.4.1 Section B of the questionnaire

Section B of the questionnaire measures the news preferences, general behaviour and opinions of participants regarding fake news. The section consists of 11 questions and the results are as follows:

Question 1: Rate the order of importance of primary news sources.

Participants rated the importance of their primary news sources on a 1-5 scale with one being the least important and five being the most important. Figure 5.3 graphically displays the rating results while Table 5.1 shows the average score for each news source.

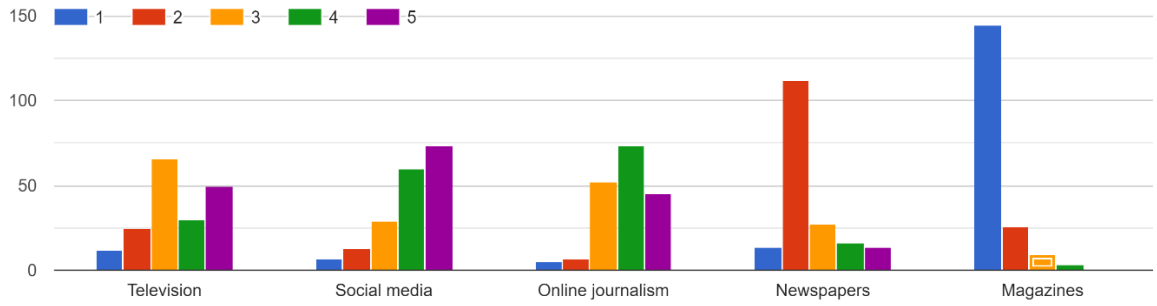

Figure 5.3 Importance ratings for primary news sources.

It is clear from the graph in Figure 5.3 that the higher scores of four and five (more important news sources) are allocated to the online sources and television while traditional news sources, such as magazines and newspapers are generally not treated as primary news sources.

Table 5.1 Average score for primary news sources.

Primary news source	Average scores
Social Media	3.98
Online journalism	3.80
Television	3.44
Newspapers	2.47
Magazine	1.28

A breakdown of the average scores per faculty is presented in Table 5.2.

Table 5.2 Breakdown of average scores per faculty.

Faculty	Television	Social Media	Online journalism	Newspapers	Magazines
Natural and Agricultural Sciences	3.40	4.46	4.47	2.26	0.83
Law	2.50	3.63	4.25	3.13	1.50
Humanities	3.68	3.79	3.74	2.58	1.20
Health Sciences	3.85	3.60	3.35	2.55	1.65
Engineering	3.40	4.24	4.16	2.48	1.32
Education	3.44	3.96	4.08	2.28	1.24
Economic and Management Sciences	3.50	3.66	3.79	2.76	1.29

The average scores per faculty (Figure 5.2) indicate that there are no significant differences among participants from the various faculties and that most participants, regardless of the faculty where they study, prefer online news sources.

Question 2: Which social media applications do you use to read news?

The aim of this question was to determine which social media platforms are preferred by participants as news sources. The results are shown in Figure 5.4.

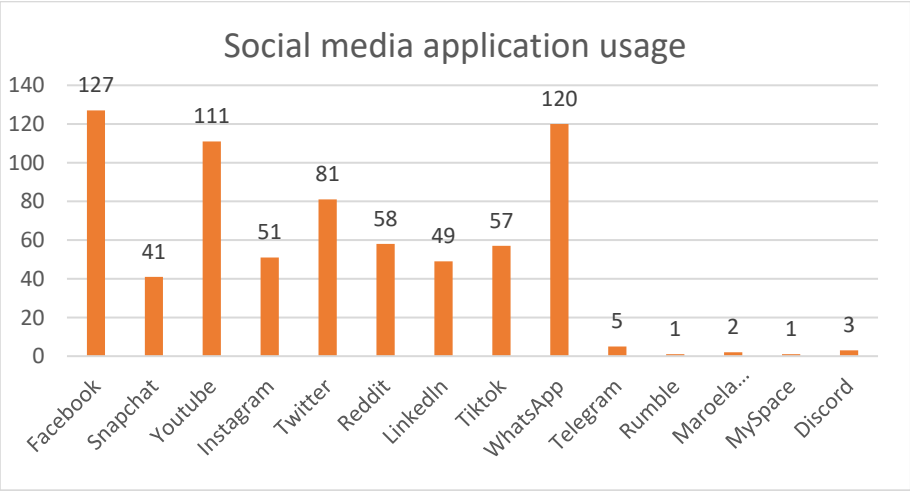

Figure 5.4 Social media application usage.

Participants were allowed to list as many social media platforms as they wished. The most popular social media platforms used by participants are Facebook (69%), WhatsApp (66%) and YouTube (61%).

Question 3: Are you aware of fact-checking web sites?

The response to Question 3 was a simple yes or no response as participants had to indicate whether they were aware of fact-checking web sites. Less than half of the participants (40%) were aware that there are fact-checking web sites, such as PolitiFact, Factcheck and the Washington Post Fact Checker, while 60% (110 participants) did not know that fact-checking web sites exist. A summary of the yes/no responses (percentages) per faculty is presented in Table 5.3.

Table 5.3 Distribution of participants per faculty who are aware of fact-checking web sites.

Faculty	**Yes (%)**	**No (%)**
Natural and Agricultural Sciences	47	53
Law	38	62
Humanities	53	47
Health Sciences	30	70
Engineering	50	50
Education	40	60
Economic and Management Sciences	21	79

It is interesting to note that it is only in the Faculty of Humanities where the majority of students are aware of the fact-checking facilities as opposed to those who are not aware of the facilities. The faculties of Economic and Management Sciences (79%) and Health Sciences (70%) recorded the highest number of students who are not aware of fact-checking facilities.

Question 4: How often do you use fact-checking web sites to verify information?

Those participants who specified that they are aware of fact-checking web sites (in Question 3) were then asked to indicate how frequently they use these fact-checking facilities. The results are displayed in Figure 5.5.

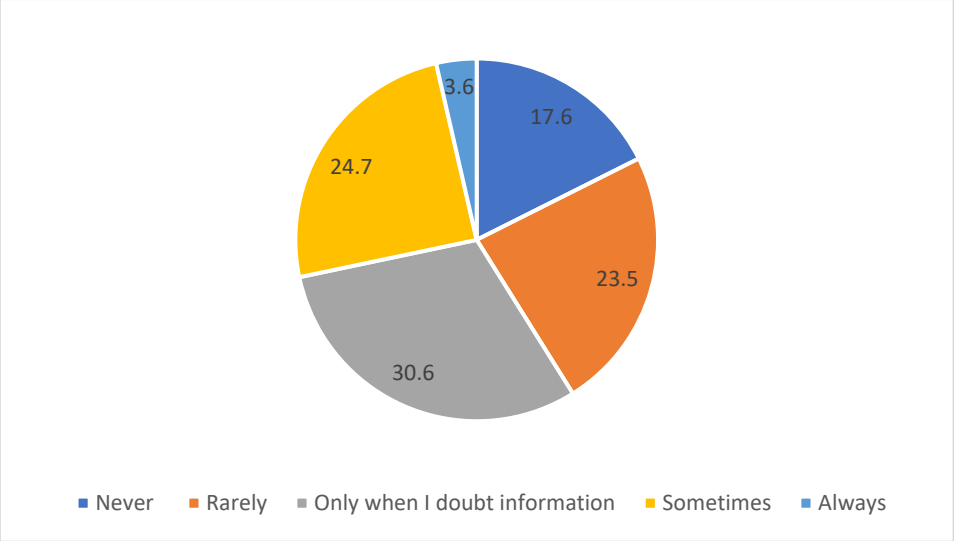

Figure 5.5 Distribution of participants who make use of fact checkers.

More than 40% of respondents indicated that they never or rarely make use of existing fact checkers. This is alarming, as all the students responding to this question do indeed know that fact checkers exist, however, they do not make use of them.

Question 5: When in doubt, do you check the source of news items?

Apart from the use of fact-checking web sites, this question determines whether participants verify the source of news items in order to identify potential fake news items. Figure 5.6 presents the results, while Table 5.4 shows a breakdown of responses per faculty.

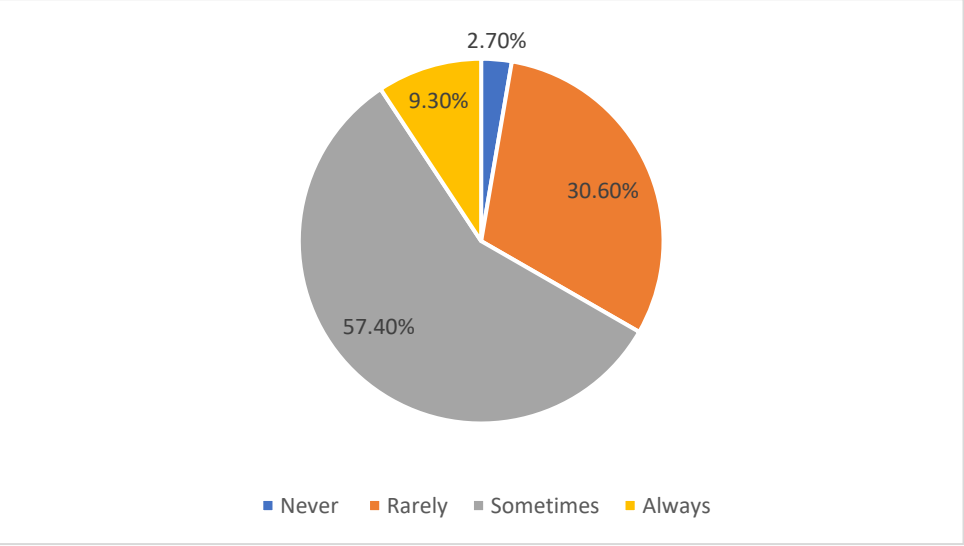

Figure 5.6 Distribution of participants who verify the source of potential fake news items.

From the overall results in Figure 5.6 it can be seen that two thirds of all participants verify, at least sometimes, the source of news items to make sure that it is not fake news.

Table 5.4 Distribution of participants per faculty who verify the source of news items.

Faculty	Never	Rarely	Sometimes	Always
Natural and Agricultural Sciences	8%	36%	53%	3%
Law	25%	37%	25%	13%
Humanities	5%	21%	69%	5%
Health Sciences	5%	25%	70%	0%
Engineering	3%	31%	54%	12%
Education	12%	44%	44%	0%
Economic and Management Sciences	2%	28%	65%	5%

Most of the participants verify the source of news items at least sometimes. The results for the Faculty of Law are interesting, as this faculty has the highest percentage of students who never checked any source, and at the same time also the highest percentage of students that always checked the source of news items.

Question 6: Do you read the content of news items or just the headlines?

The aim of Question 6 is to verify whether students try to understand the entire context of a news story instead of drawing conclusions based on just the headlines of a news article. As with the previous question, the results are presented in both graphical form (Figure 5.7), as well as a breakdown of responses per faculty (Table 5.5).

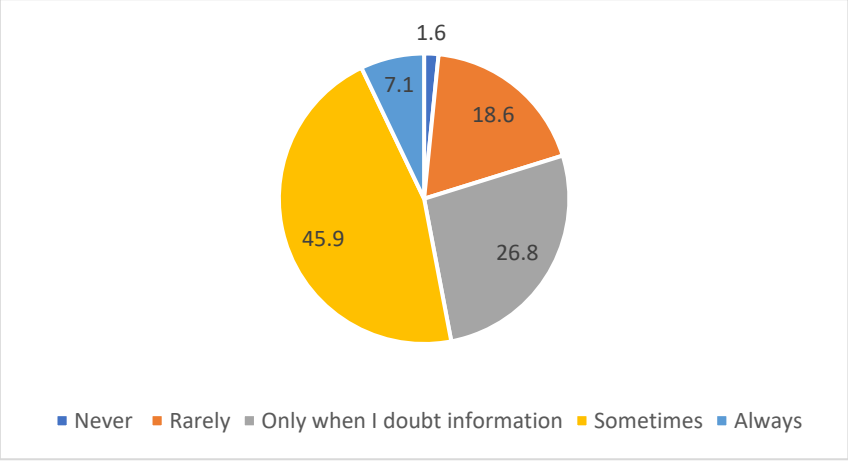

Figure 5.7 Distribution of participants who read the content of news items.

Only 7% of participants always read the contents of news articles, while most indicated that they only read the content sometimes.

Table 5.5 Distribution of participants per faculty who read the contents of news items.

Faculty	Never	Rarely	Only when I doubt information	Sometimes	Always
Natural and Agricultural Sciences	4%	20%	25%	47%	4%
Law	12.5%	25%	12.5%	25%	25%
Humanities	0%	5%	32%	53%	10%
Health Sciences	5%	15%	5%	75%	0%
Engineering	0%	15%	35%	38%	12%
Education	0%	20%	40%	36%	4%
Economic and Management Sciences	3%	26%	26%	42%	3%

The Faculty of Law has the highest percentage of participants that never read the contents of news articles and rather focused on news headlines only. Students from the Faculty of Health Sciences also tend to focus on headlines only as there was no respondent from this faculty who indicated that he/she always read the contents of news items.

Question 7: Do you check the date of news stories to verify the relevancy of the news?

The actual date of news stories can be viewed as one way of verifying whether the news story is outdated or no longer relevant. Question 7 determines if students check the dates of news stories. The results are presented in Figure 5.8 below.

From the graphical display in Figure 5.8 it can be seen that most participants do check the dates; i.e., sometimes, or when they are not sure about the contents, or always. The breakdown per faculty of these results is presented in Table 5.6.

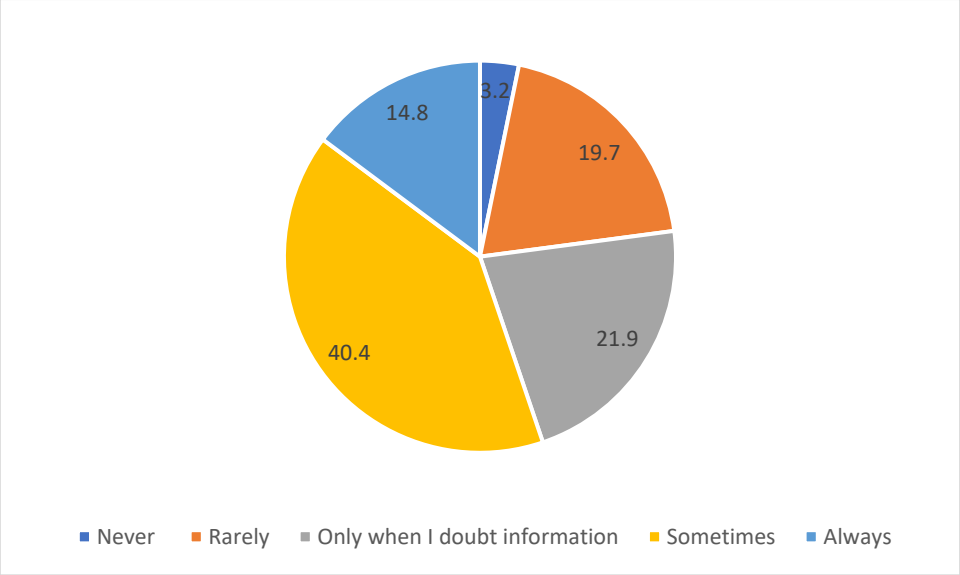

Figure 5.8 Distribution of participants who verify the dates of news items.

Table 5.6 Distribution of participants per faculty who verify the dates of news items.

Faculty	Never	Rarely	Only when I doubt information	Sometimes	Always
Natural and Agricultural Sciences	6%	23%	17%	44%	10%
Law	12%	13%	38%	12%	25%
Humanities	0%	5%	42%	32%	21%
Health Sciences	5%	35%	5%	55%	0%
Engineering	7%	15%	31%	20%	27%
Education	0%	24%	20%	44%	12%
Economic and Management Sciences	5%	21%	28%	39%	7%

An interesting observation is that as many as 40% of students from the Faculty of Health Sciences never or rarely checked the date of a news story.

Question 8: Do you crosscheck news stories with other media institutions?

Another technique of verifying whether a news item is potentially fake news is to crosscheck the news item with other media institutions. The aim of Question 8 is to determine if students do indeed crosscheck news stories when they are uncertain about the contents. A graph of the results is presented in Figure 5.9.

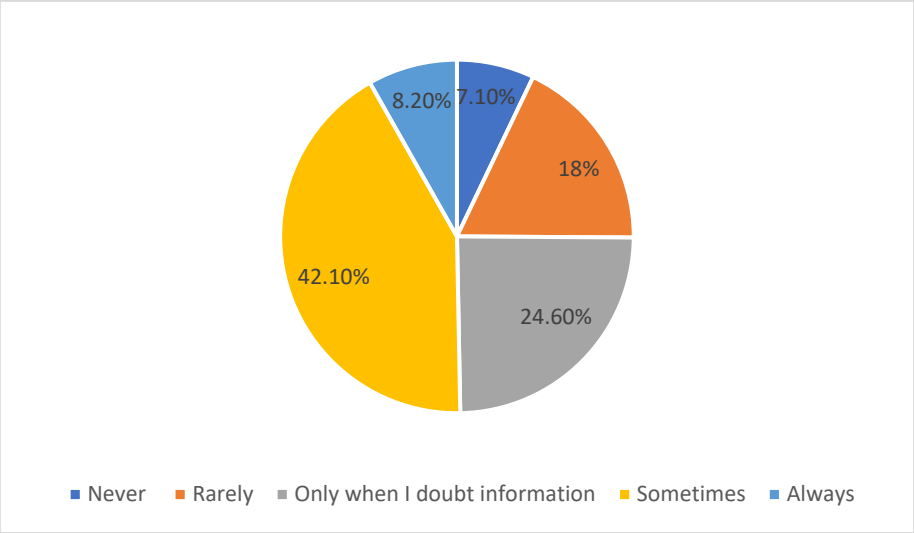

Figure 5.9 Distribution of participants who crosscheck news stories.

Most of the participants have indicated that they do indeed verify news stories when they feel uncertain about the contents. Surprisingly, only 15.3% responded that they never or rarely crosscheck news stories.

The responses per faculty are summarised in Table 5.7.

Table 5.7 Distribution of participants per faculty who crosscheck news stories.

Faculty	Never	Rarely	Only when I doubt information	Sometimes	Always
Natural and Agricultural Sciences	7%	17%	23%	46%	7%
Law	12%	12%	26%	38%	12%
Humanities	12%	5%	42%	36%	5%
Health Sciences	5%	20%	5%	70%	0%
Engineering	16%	26%	26%	20%	12%
Education	4%	16%	24%	48%	8%

Economic and Management Sciences	5%	24%	29%	35%	7%

The Faculty of Engineering has the least number of students who crosscheck news stories while the Faculty of Law has the most students who always crosscheck the validity of news stories.

Question 9: Do you ask expert opinions to make sure the news is accurate?

The use of expert opinion is another way of identifying misleading information and Question 9 determines the extent to which participants make use of experts to verify potential fake news items. The results for all participants are depicted in Figure 5.10. The distribution of responses per faculty is presented in Table 5.8.

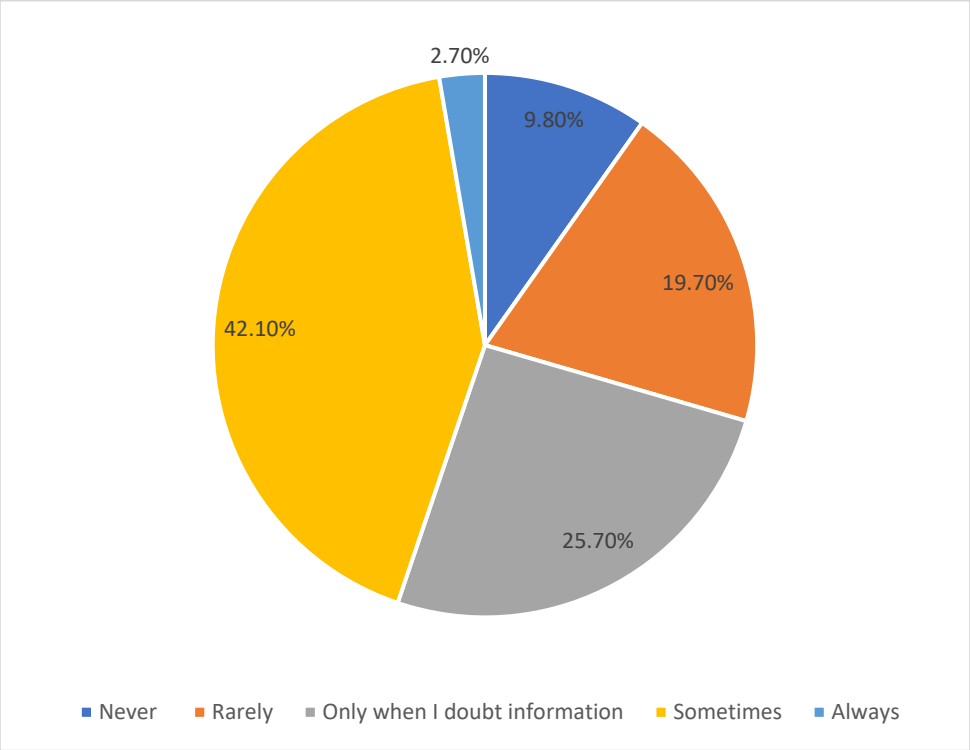

Figure 5.10 Distribution of participants who make use of expert opinion to verify news stories.

From the results in Figure 5.10 it seems as if many students make use of an expert opinion sometimes, or when they doubt the information. This appears to be a high number of participants. However, there may have been confusion on what constitutes an expert – for example, asking the opinion of a fellow student is hardly an expert opinion. Another practical problem may be that not everyone knows an expert who could help with the identification of misinformation.

Table 5.8 Distribution of participants per faculty who make use of expert opinion to verify news stories.

Faculty	Never	Rarely	Only when I doubt information	Sometimes	Always
Natural and Agricultural Sciences	10%	18%	18%	49%	5%
Law	12%	0%	38%	38%	12%
Humanities	10%	5%	48%	37%	0%
Health Sciences	0%	20%	15%	60%	5%
Engineering	24%	20%	23%	30%	3%
Education	4%	40%	24%	32%	0%
Economic and Management Sciences	10%	22%	31%	37%	0%

The Faculty of Health Sciences has the most students who responded that they are using expert opinions to verify potential misinformation; 80% indicated that they use experts when they doubt the information, sometimes or always. The Faculties of Education and Engineering reported the highest number of students (45% and 42%, respectively) that never, or rarely makes use of expert opinions.

Question 10: List the news topics that you have recently shared with others.

In an effort to get some insight on how news (and fake news) spreads, participants were asked to list the news topics that they have recently shared with others. The results are presented in Figure 5.11. It should be noted that participants may indicate as many news topics as they wish which means that the results are more than 183 (the number of participants).

More than 50% of the students indicated that they do not share any news items while the weather, crime, sports and Internet memes appeared to be the most popular items to share with others.

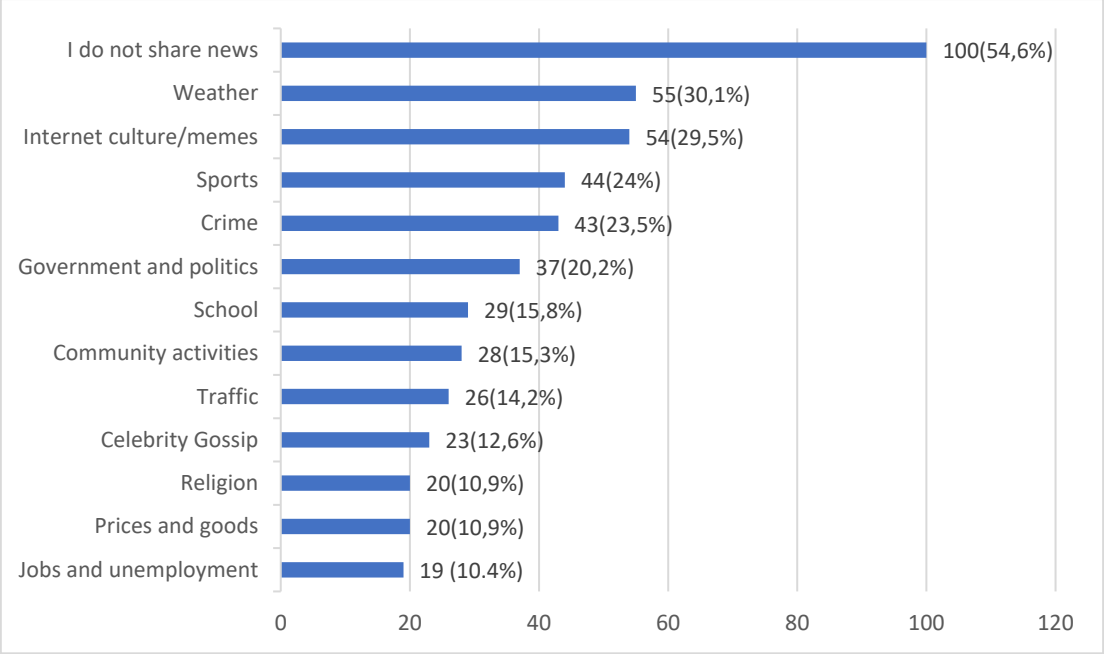

Figure 5.11 Sharing of news items by participants.

Question 11: List the reasons for sharing news with others.

Respondents who indicated that they do share news items with others were then asked to provide the reasons why they share news articles. The results are graphically depicted in Figure 5.12 and, as with Figure 5.11, the total number of responses are higher than the sample size. This is due to the fact that respondents may choose as many reasons as they wish.

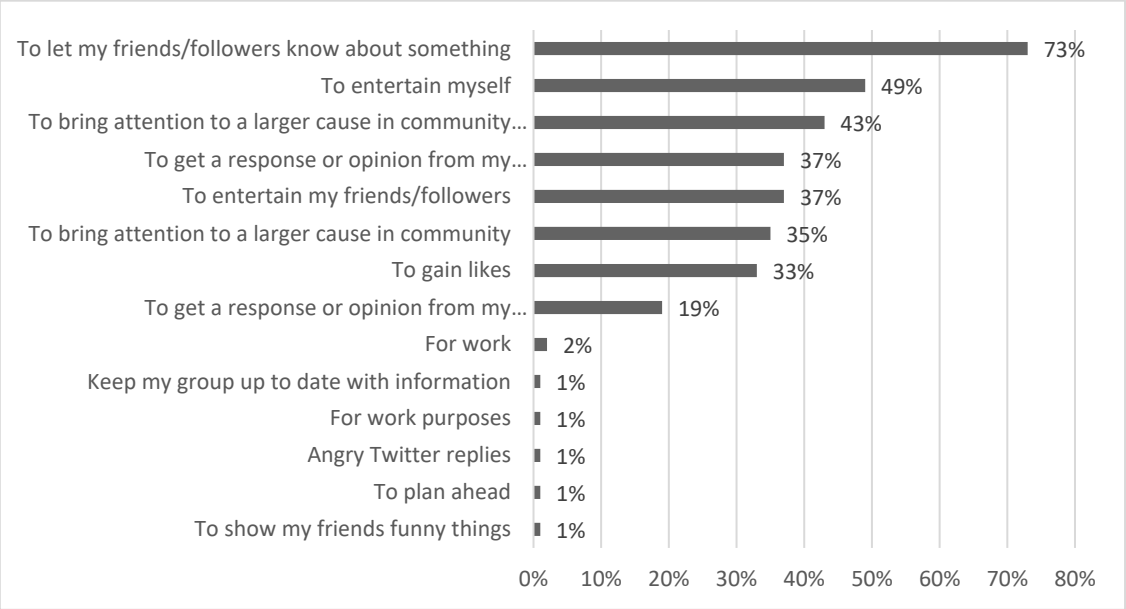

Figure 5.12 Reasons for sharing news items.

Most commonly the participants would share news that their friends/followers would like and to entertain them. Some participants would share news to get a response or opinion from their friends/followers or to try and change their friends/follower's opinion.

This concludes the presentation of the results of Section B of the questionnaire. In the next chapter some recommendations based on these results will be presented. The following section will present results from Section C of the questionnaire.

5.4.2 Section C of the questionnaire

Section C of the questionnaire was designed to assess participants' knowledge of fake news items. Ten news articles (7 fake and 3 real) were presented to the participants who had to classify them as either fake or real. In addition to classifying the news story, participants also had to rate how believable and trustworthy the news articles were to them.

News article 1 (a fake article): An Instagram post claiming that the death rate for COVID-19 vaccinated people is higher than that of unvaccinated people

This Instagram post is fake and the results are graphically presented in Figure 5.13.

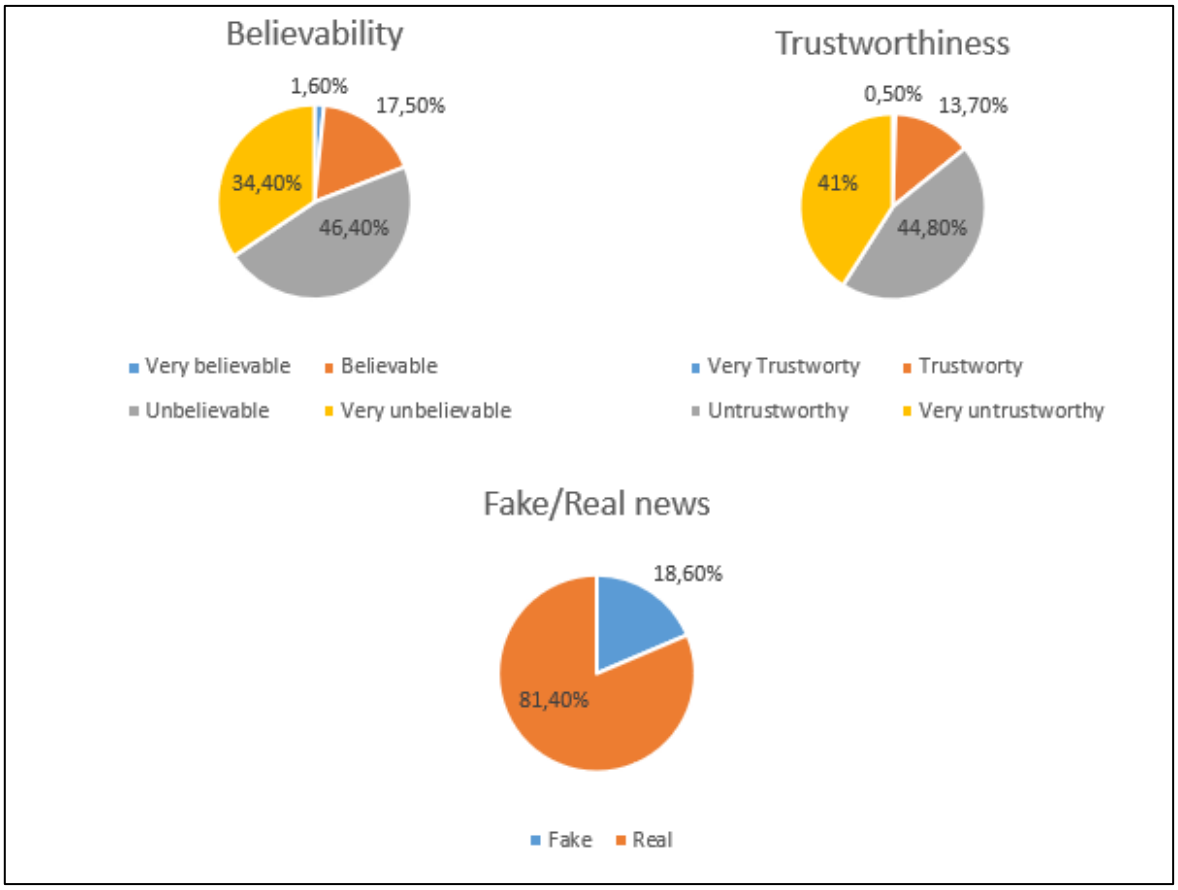

Figure 5.13 Results for fake news article 1.

More than 81% of the respondents identified the news article correctly as fake news. This is in line with the more than 80% respondents who also identified the article as unbelievable (and very unbelievable), as well as untrustworthy (and very untrustworthy). At the time, COVID-19 was a prominent news item and participants explained that prior news articles helped them to identify the fake news item.

The news classification responses per faculty are presented in Table 5.9.

Table 5.9 News article 1: Real and fake news classification distribution of participants per faculty.

Faculty	Real	Fake
Natural and Agricultural Sciences	18%	82%
Law	12%	88%
Humanities	5%	95%
Health Sciences	15%	85%
Engineering	23%	77%
Education	20%	80%
Economic and Management Sciences	10%	90%

The Faculty of Engineering performed the worst with 23% classifying the news article as real. In general, most participants classified the news article correctly as fake news with the faculties of Humanities and Economic and Management Sciences recording the highest correct responses (more than 90%).

News article 2 (a fake article): A TikTok video claiming that after receiving the COVID-19 vaccine, you will be unable to donate blood or plasma

This TikTok video is fake. The video had no sources of where the information was obtained and went viral online with a large number of views, likes and comments in a short space of time. The results are graphically presented in Figure 5.14.

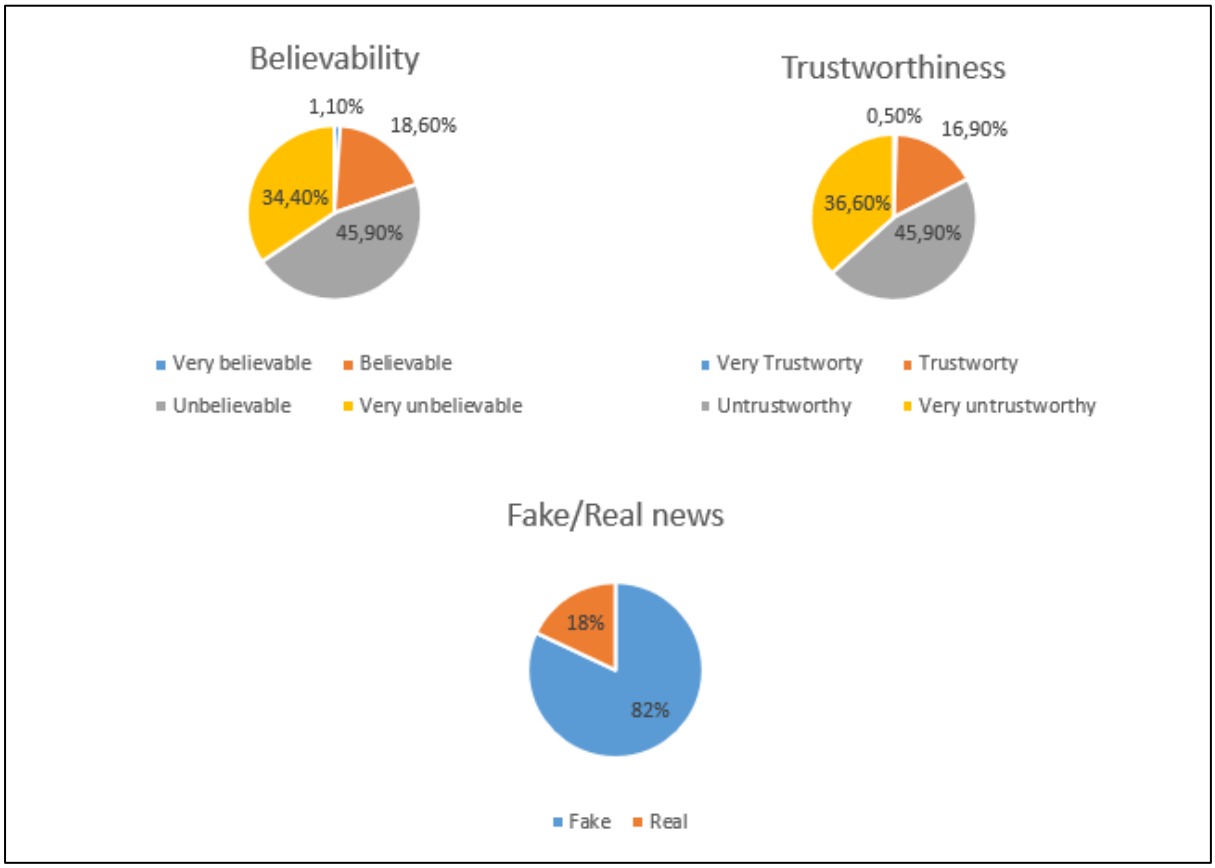

Figure 5.14 Results for fake news article 2.

As with the first COVID-19-related question, the overwhelming majority of participants classified the news item correctly as fake news with equally high unbelievable and untrustworthy ratings. The breakdown per faculty is summarised in Table 5.10.

Table 5.10 News article 2: Real and fake news classification distribution of participants per faculty.

Faculty	Real	Fake
Natural and Agricultural Sciences	19%	81%
Law	13%	87%
Humanities	16%	84%
Health Sciences	20%	80%
Engineering	15%	85%
Education	20%	80%
Economic and Management Sciences	21%	79%

Table 5.10 shows that the majority of respondents from all faculties correctly classified the news item as fake news.

News article 3 (a real article): A newspaper article that announces that Japan will dump contaminated water into the sea

This is a real news article. The article was published by The Guardian which is a well-known source and trusted by many participants. The results are displayed in Figure 5.15.

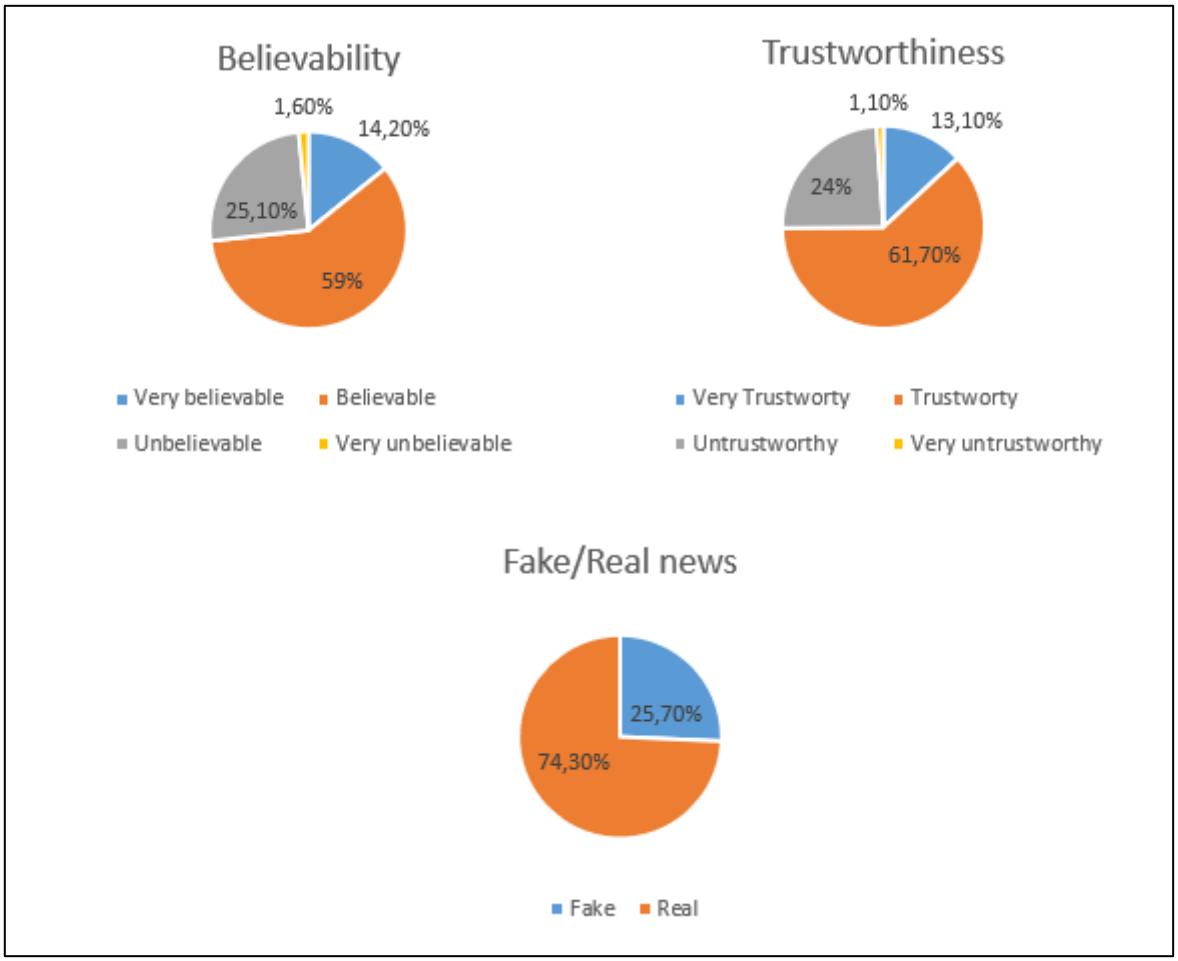

Figure 5.15 Results for real news article 3.

It appears that the well-known source was enough reason for more than 70% of the respondents to classify this news story as a real story. More than 70% also believe that the news story is believable (or very believable) and trustworthy (or very trustworthy). Many of the students who incorrectly classified the news as fake news explained that they would not expect Japan to hurt the environment and hence the fake news classification. The classification distribution per faculty is presented in Table 5.11.

Table 5.11 News article 3: Real and fake news classification distribution of participants per faculty.

Faculty	Real	Fake
Natural and Agricultural Sciences	85%	15%
Law	62%	38%
Humanities	68%	32%
Health Sciences	65%	35%
Engineering	73%	27%
Education	64%	36%
Economic and Management Sciences	79%	21%

The faculties of Law and Education had the highest incorrect (fake) classifications while Natural and Agricultural Sciences and Economic and Management Sciences reported the highest correct (real) classifications.

News article 4 (a real article): A newspaper article that announces that a woman received a life sentence in prison for murder witnessed by a parrot

This is a real news article. The article was published by The New York Post which is a well-known source of news. Figure 5.16 presents the results in graphical form.

Despite the well-known source, this is a hard to believe story and appears to be too far-fetched for some of the participants. Half of the respondents classify this real news story incorrectly as fake. Less than half the respondents indicated that the story is believable, while more than 50% indicated that it is trustworthy (probably due to the well-known and reliable source). Table 5.12 shows the responses per faculty.

Table 5.12 News article 4: Real and fake news classification distribution of participants per faculty.

Faculty	Real	Fake
Natural and Agricultural Sciences	53%	47%
Law	75%	25%
Humanities	43%	57%
Health Sciences	55%	45%
Engineering	58%	42%
Education	40%	60%
Economic and Management Sciences	53%	47%

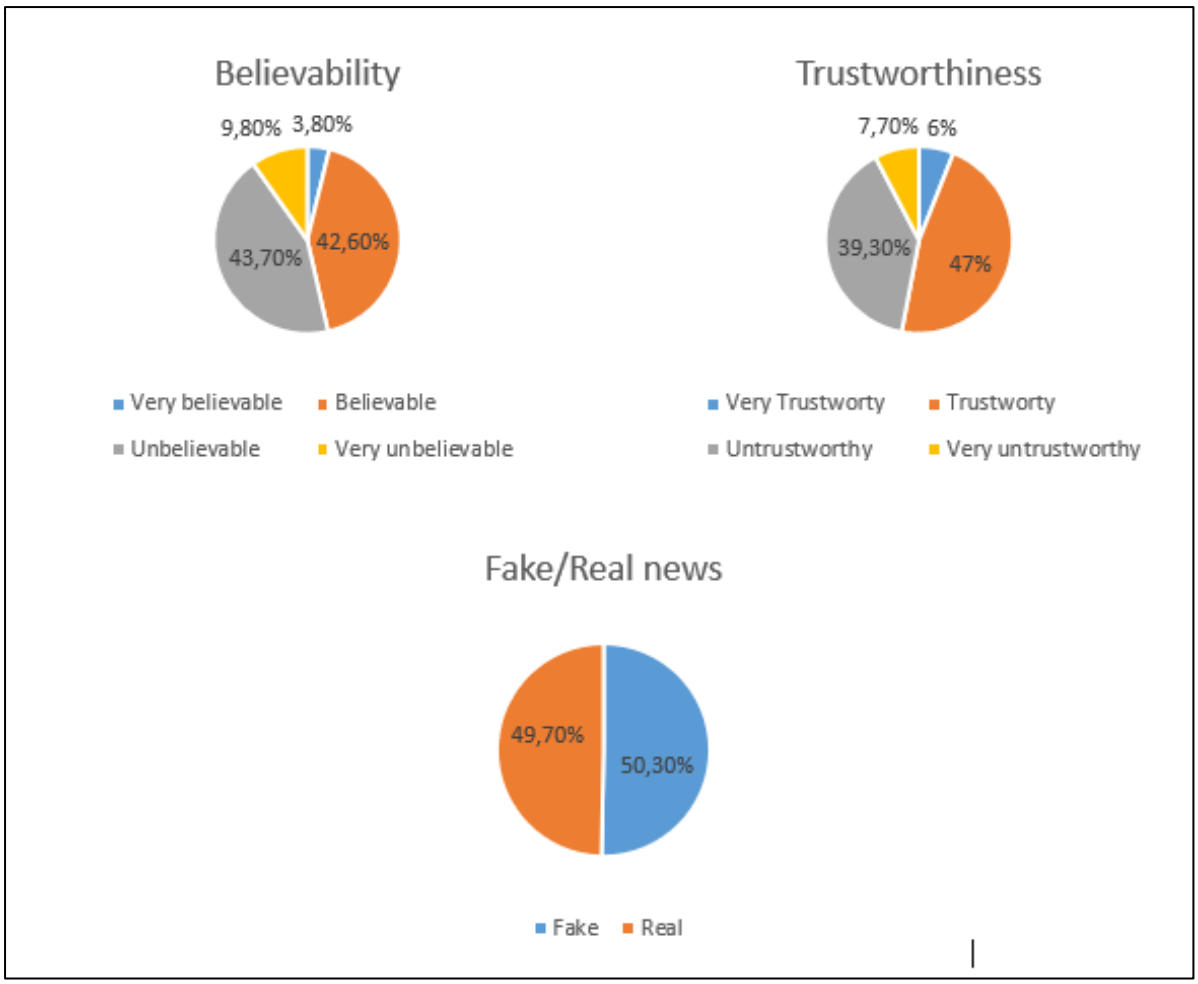

Figure 5.16 Results for real news article 4.

From Table 5.12 it can be seen that participants generally performed poor with the classification. The exception is the Faculty of Law where 75% of the respondents correctly classified the news story as real. Many participants pointed out that the news article was too bizarre to believe and expected it to be fake news. Some of the participants indicated that they valued the trustworthiness of the news source while only a few reported that they tried to find other news sources to validate the information which helped them to correctly identify it as a real news article.

News article 5 (a real article): A Twitter post claiming that marijuana can increase the risk of schizophrenia and psychotic disorders

This is a real news item. This post would require research or prior knowledge to know if it is real or fake news. Figure 5.17 presents the results in graphical form.

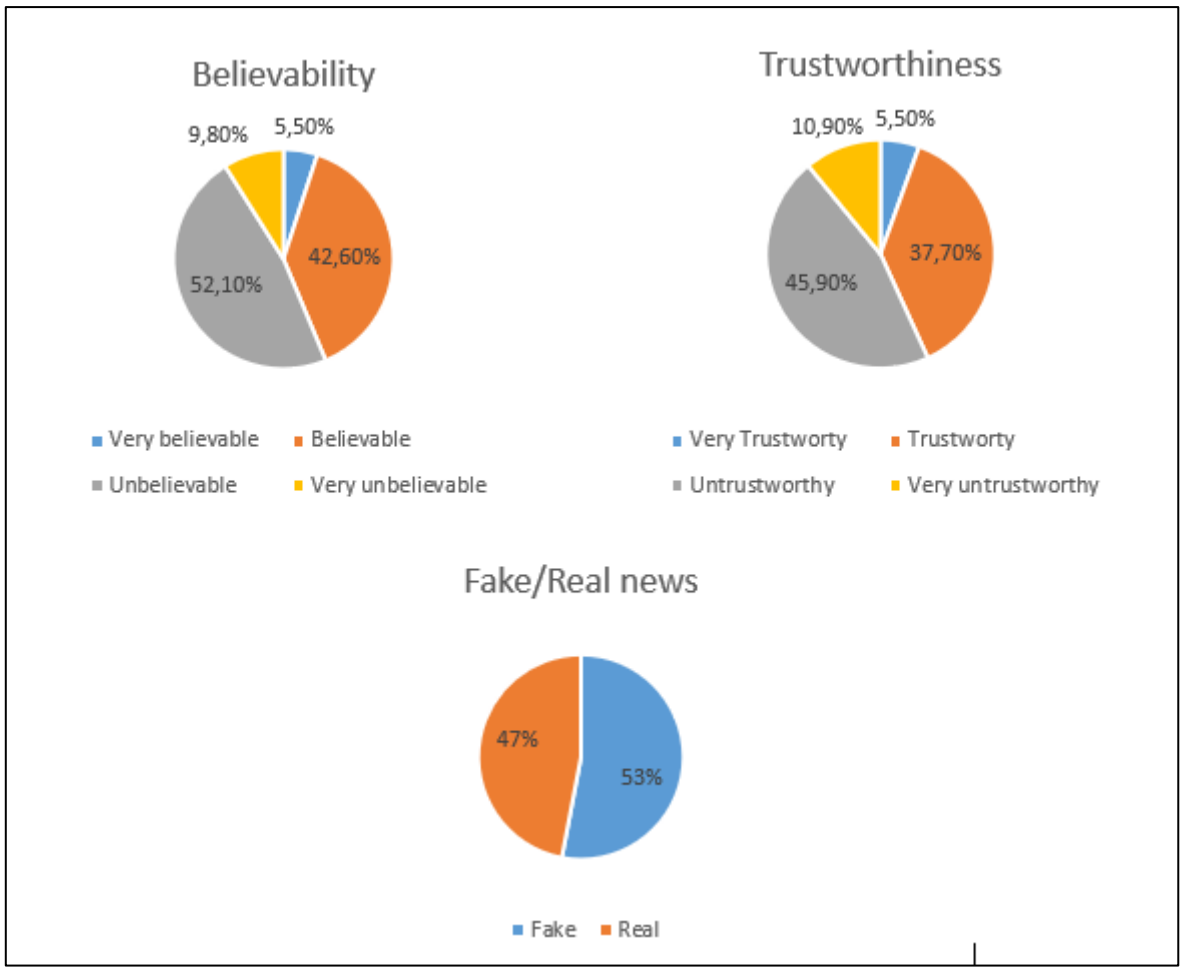

Figure 5.17 Results for real news article 5.

More than half (53%) of respondents incorrectly classified this news tweet as fake news. Most respondents also indicated that the tweet is unbelievable and untrustworthy. Some of the reasons provided for the classification by participants include that verified Twitter accounts are not supposed to tweet fake news, the low number of likes is a reason for not believing the information, and that they rely on their previous knowledge to classify the news item.

The breakdown of responses per faculty is presented in Table 5.13

Table 5.13 News article 5: Real and fake news classification distribution of participants per faculty.

Faculty	Real	Fake
Natural and Agricultural Sciences	62%	38%
Law	12%	88%
Humanities	43%	57%
Health Sciences	60%	40%
Engineering	42%	58%
Education	40%	60%

Economic and Management Sciences	42%	58%

The responses per faculty in Table 5.13 shows that the Faculty of Law performed the worst and 88% of respondents incorrectly indicated that the tweet is fake news. The faculties of Natural and Agriculture Sciences and Health Sciences recorded the most correct responses.

News article 6 (a fake article): A YouTube video claiming Durban metro police were seen stealing looted goods and driving off during the Durban protests

This is a fake news item. The video was taken by a random stranger and posted online, receiving many views and shares. The results are graphically displayed in Figure 5.18.

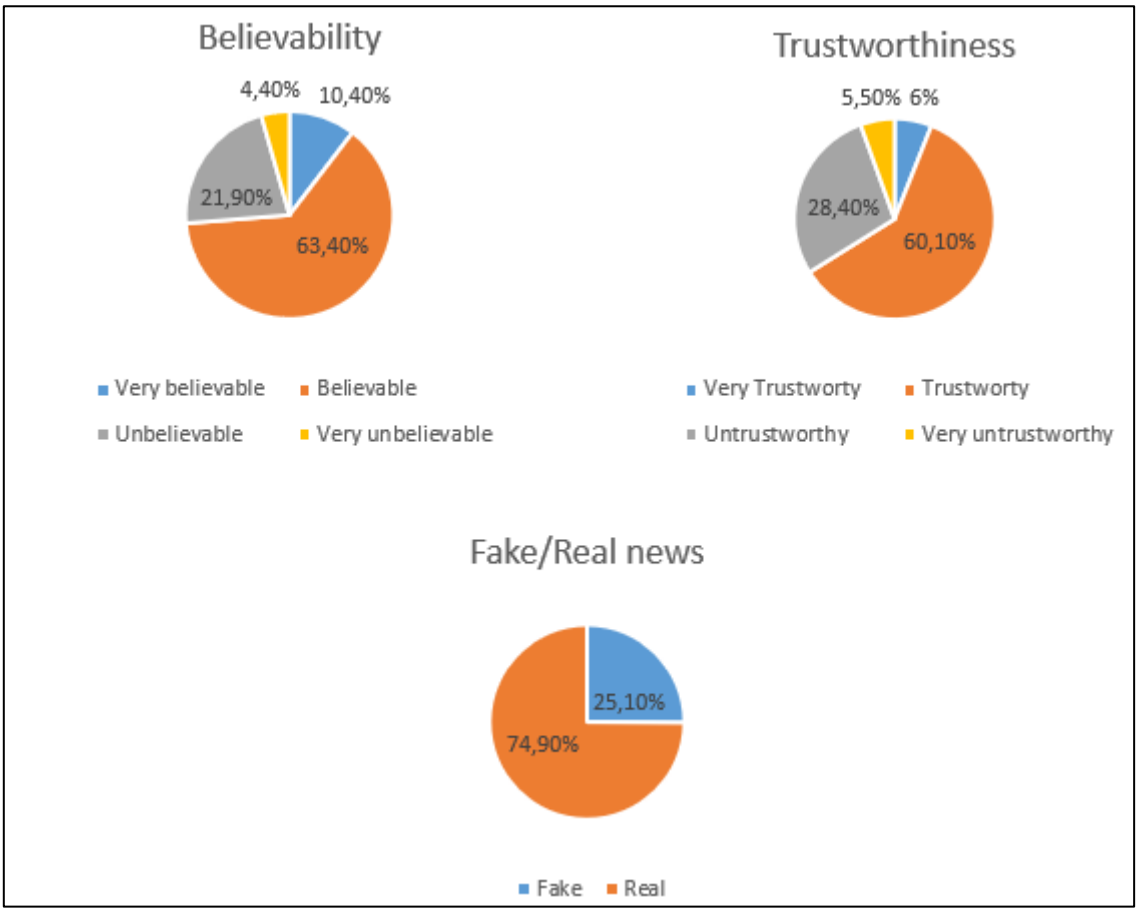

Figure 5.18 Results for fake news article 6.

A large majority (75%) of participants classified this news article incorrectly as real news. Most participants viewed the video as believable or very believable, as well as trustworthy and very trustworthy. Participants stated that the quality of the video made them believe that it is a real news story. Furthermore, some of the participants stated that they do not trust the South African police and expect them to engage in criminal acts like stealing. A small number of

respondents said that they did additional research and found a statement from the Durban municipality saying that the video was fake news.

Table 5.14 shows the classification distribution per faculty.

Table 5.14 News article 6: Real and fake news classification distribution of participants per faculty.

Faculty	Real	Fake
Natural and Agricultural Sciences	77%	23%
Law	50%	50%
Humanities	79%	21%
Health Sciences	70%	30%
Engineering	62%	38%
Education	72%	28%
Economic and Management Sciences	87%	13%

The statistics in Table 5.14 clearly show how the majority of respondents in each faculty classified the news item incorrectly as real. The Faculty of Law performed the best with half of the respondents classifying the news story correctly as fake.

News article 7 (a fake article): A Twitter video claiming that dolphins returned to the canals in Venice during the COVID-19 pandemic lockdown period

This is a fake news item. The video was shared across many social media platforms and appears to be a very popular video with a large number of views. Figure 5.19 graphically depicted the classification results.

Only 40% of respondents correctly classified the news video as fake news. The majority also thought that it was a believable and trustworthy news video. One of the reasons why the post was mostly incorrectly identified was because many of the participants had previously seen the news on other social media platforms and believed it to be real.

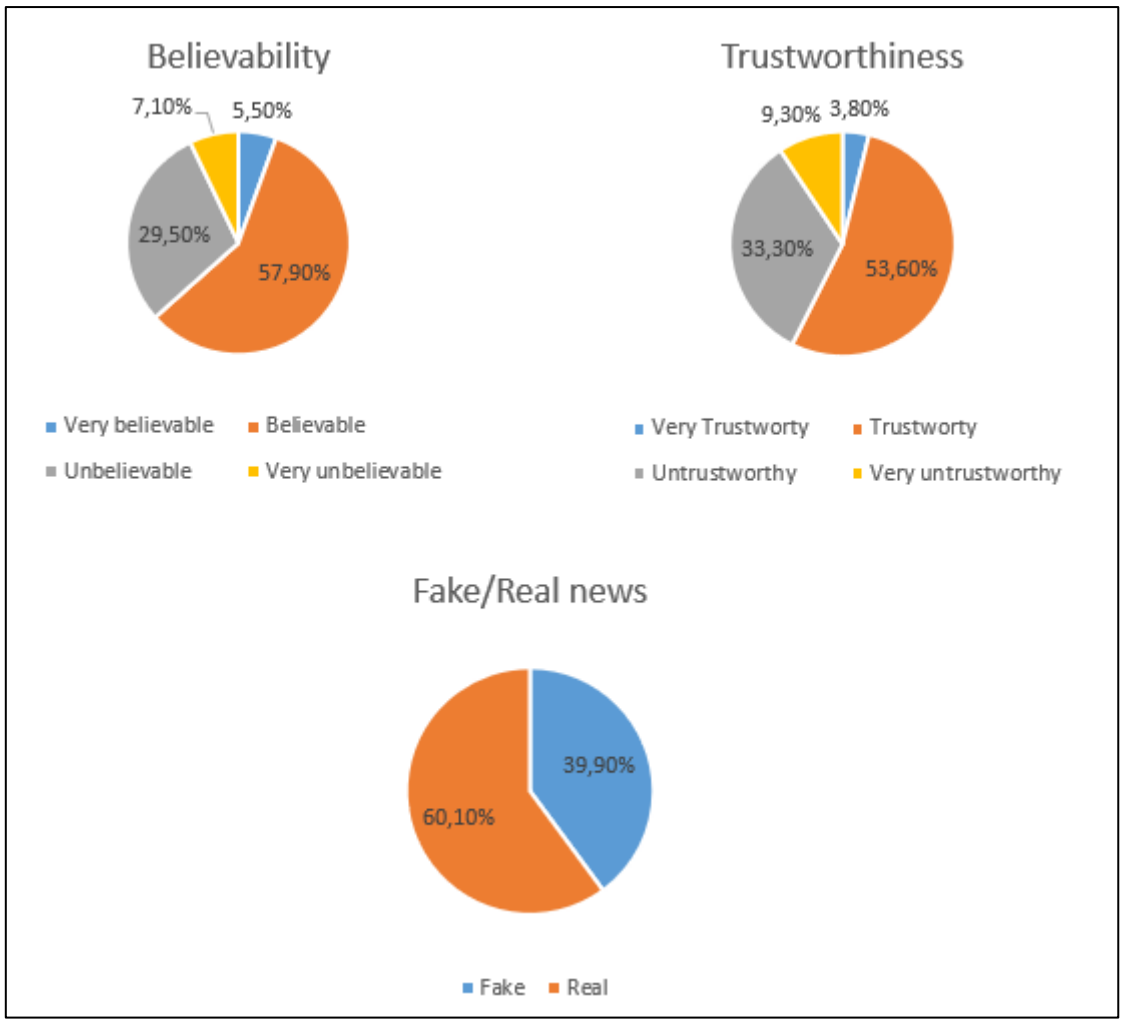

Figure 5.19 Results for fake news article 7.

A breakdown per faculty of the classification results is presented in Table 5.15.

Table 5.15 News article 7: Real and fake news classification distribution of participants per faculty.

Faculty	Real	Fake
Natural and Agricultural Sciences	71%	29%
Law	37%	63%
Humanities	42%	58%
Health Sciences	30%	70%
Engineering	62%	38%
Education	64%	36%
Economic and Management Sciences	60%	40%

The Faculty of Health Sciences performed best with 70% of respondents correctly classifying the news item as fake news.

News article 8 (a fake article): A news article stating that Rory McIlroy (Golfer) was attacked by a hawk protecting a golf ball that bounced into the hawk's nest

This is a fake news item. The news article was posted by a well-known fake news web site, the Onion. This web site is famous for fooling high profile politicians and celebrities with fake news articles and it was expected that anyone with previous experience, or that had heard of the web site would be able to identify the news article as fake news. Figure 5.20 presents the results recorded.

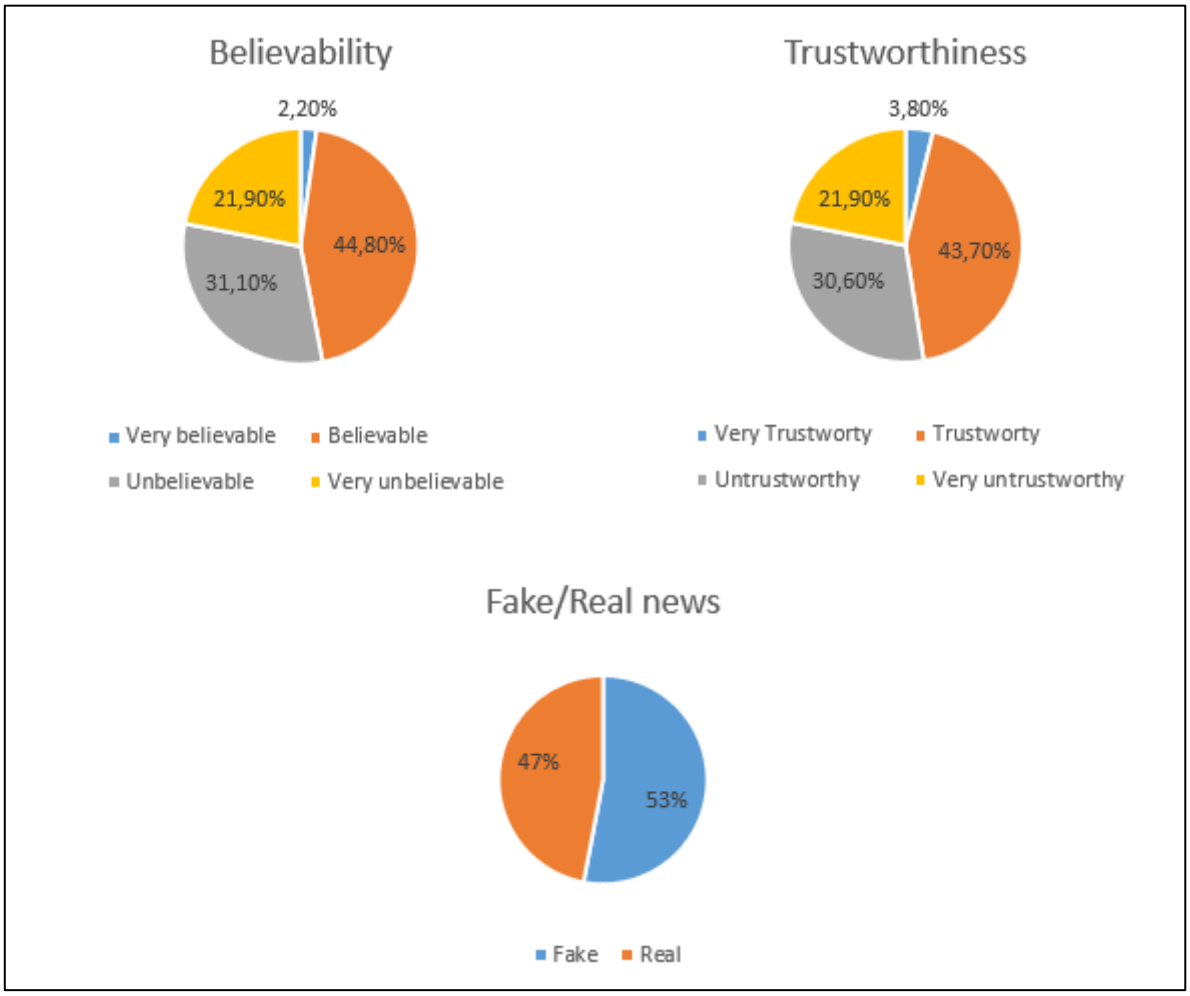

Figure 5.20 Results for fake news article 8.

Despite using a well-known fake news web site, only 53% of the respondents correctly classified the news article as fake news. The distribution of a believable and trustworthy news article was also almost 50% each. Participants that identified the news article incorrectly indicated that they did not know it came from a fake news web site.

The results per faculty are presented in Table 5.16.

Table 5.16 News article 8: Real and fake news classification distribution of participants per faculty.

Faculty	Real	Fake
Natural and Agricultural Sciences	60%	40%
Law	50%	50%
Humanities	64%	36%
Health Sciences	50%	50%
Engineering	35%	65%
Education	40%	60%
Economic and Management Sciences	40%	60%

The breakdown per faculty shows a more or less 50% vote for both real and fake news with the largest difference recorded in the faculties of Humanities and Engineering.

News article 9 (a fake article): A YouTube news video featuring the South African Minister of Social Development who claims that South Africa is ranked number one in the world in the murder of women

This is a fake news item. The news article was shared on YouTube as a live television broadcast on a credible news station. However, the Minister could not present an accurate source for the claim and the information was not true. A graphical presentation of the results is presented in Figure 5.21.

Almost 80% of the respondents incorrectly classify news article 9 as real. A large majority (80%) also indicated that the news item was believable and trustworthy. This makes news article 9 the most incorrectly classified news article presented in the survey. In Table 5.17, the responses per faculty are presented.

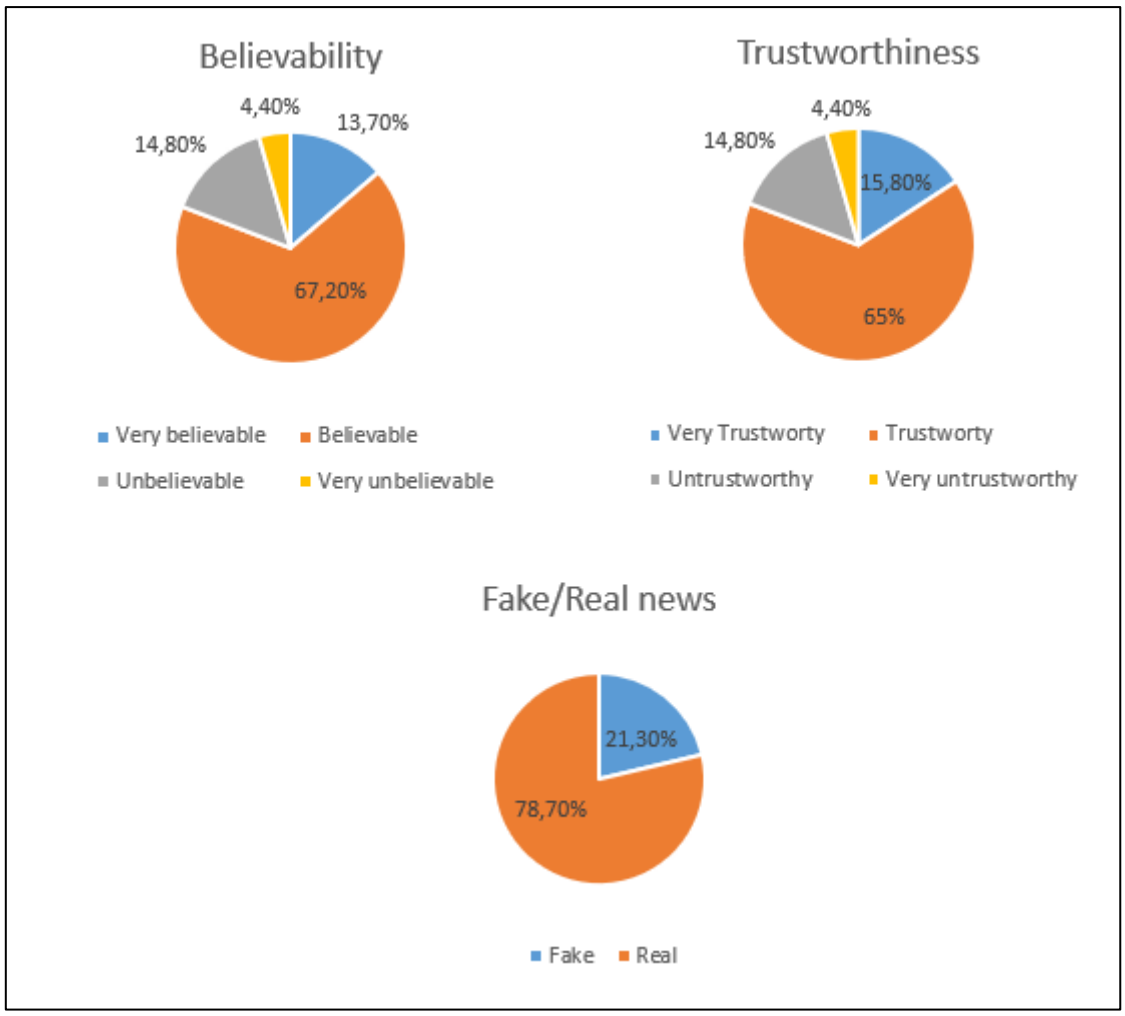

Figure 5.21 Results for fake news article 9.

Table 5.17 News article 9: Real and fake news classification distribution of participants per faculty.

Faculty	Real	Fake
Natural and Agricultural Sciences	87%	13%
Law	75%	25%
Humanities	79%	21%
Health Sciences	80%	20%
Engineering	69%	31%
Education	72%	28%
Economic and Management Sciences	79%	21%

The results in Table 5.17 show that most participants in all the various faculties incorrectly classified the fake news story as a real news story. Most participants indicated that they believed it to be real because it was a live broadcast from a credible news station. A few of

those that correctly classified it as fake news stated that they generally do not believe politicians and would prefer to do their own research before drawing a conclusion.

News article 10 (a fake article): A Facebook post claiming that South Africa's late Zulu King, Goodwill Zwelithini, received an annual salary of R71.3 million

This is a fake news item. The post originated from a completely random Facebook profile and generated a large number of likes. The results are graphically depicted in Figure 5.22.

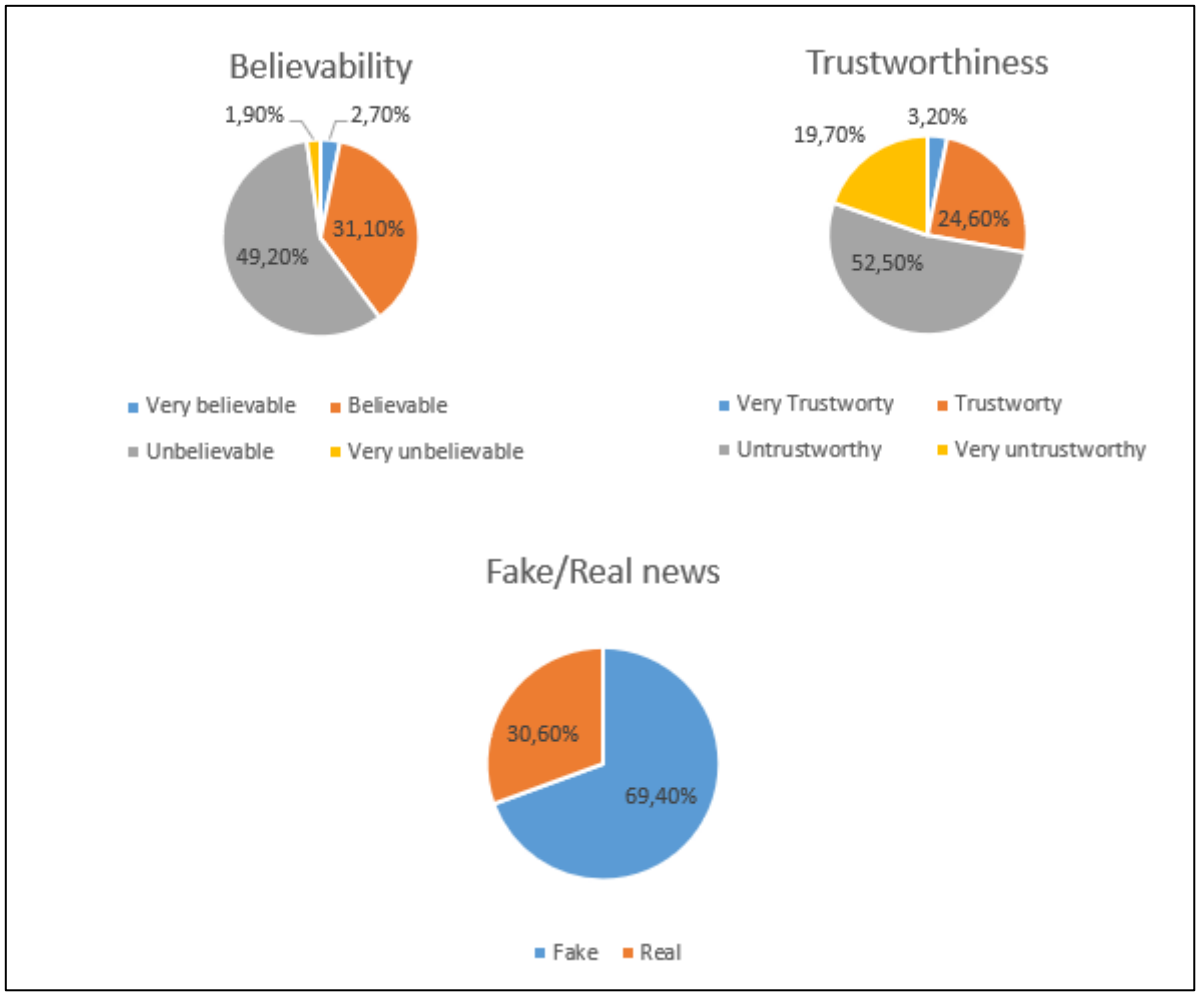

Figure 5.22 Results for fake news article 10.

Almost 70% of the respondents correctly classify the Facebook post as fake. In line with this, about 65% of the respondents thought that the news article was either unbelievable or very unbelievable and more than 72% believed the article was untrustworthy or very untrustworthy. The responses per faculty are presented in Table 5.18.

Table 5.18 News article 10: Real and fake news classification distribution of participants per faculty.

Faculty	Real	Fake
Natural and Agricultural Sciences	28%	72%
Law	0%	100%
Humanities	16%	84%
Health Sciences	30%	70%
Engineering	31%	69%
Education	44%	56%
Economic and Management Sciences	40%	60%

The distribution per faculty shows that most respondents within each faculty classified the post correctly as being false. The Faculty of Law shows an outlying result with a 100% classifying the news story correctly as fake news.

The last question in Section C of the questionnaire (Question 11) requests participants to indicate which of the ten news stories they would share with friends and/or family. The results are presented in graph form in Figure 5.23.

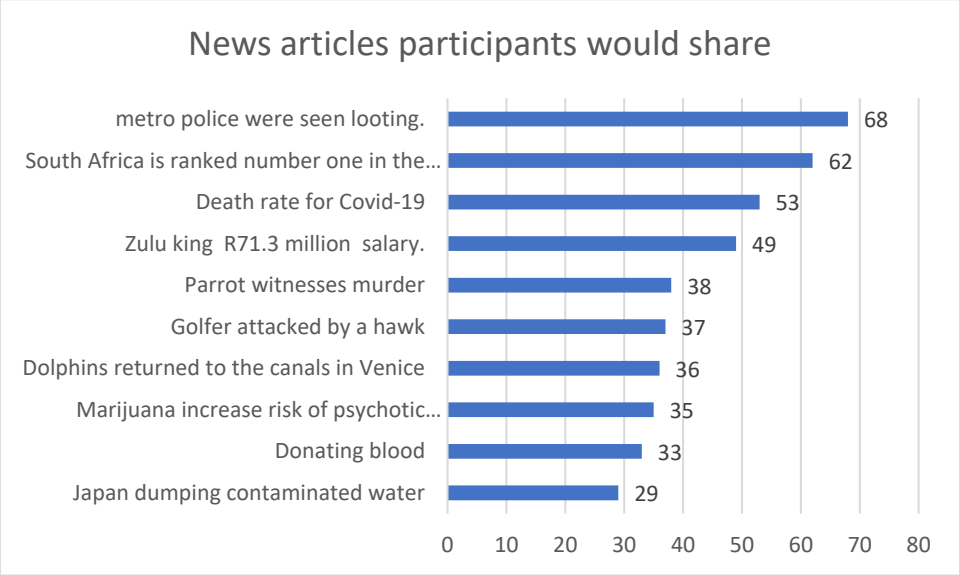

Figure 5.23 Distribution of how news stories would be shared by participants.

It is interesting to note that respondents favour stories about South Africa, as well as COVID-19 news stories to share with others. News stories that could affect the respondent's own way of living were much more commonly shared to friends and family members. Many respondents would not share any news stories that originated outside of South Africa or had any effect on them.

This concludes the presentation of the results as recorded from all the participants. To close this section, a final summary of the news story classification results (Section C of the questionnaire) is presented in Table 5.19 below.

Table 5.19 Fake news awareness results.

News item	Fake or Real	Number of correct classifications	Percentage of correct classifications
1. Death rate for Covid-19	Fake	149	81%
2. Donating blood	Fake	150	82%
3. Japan dumping contaminated water	Real	136	74%
4.Parrot witnesses murder	Real	91	49%
5. Marijuana can increase risk of psychotic disorders	Real	86	47%
6. Durban metro police were seen loading their van with looted goods.	Fake	46	25%
7. Dolphins returned to the canals in Venice	Fake	73	40%
8. Golfer attacked by a hawk	Fake	97	53%
9. South Africa is ranked number one in the murder of women.	Fake	39	21%
10. South Africa's late Zulu King Goodwill Zwelithini received a R71.3 million annual salary.	Fake	127	69%

The table confirms earlier results that the two South African news stories (numbers 6 and 9) had the worst percentage of correct classifications while contemporary stories relating to Covid-19 (numbers 1 and 2) performed best in terms of correct classifications.

The results presented in this chapter serve as a report of the responses as they were recorded. In the next chapter, Chapter 6, a final discussion, interpretations and recommendations will be presented.

5.5 Summary

In Chapter 5, a discussion of phase four (*evaluation phase*) of the design science framework that is utilised in this study was presented. The administration of the fake news awareness

survey process was explained and demographic details of the participants were highlighted. Results from Section B (preferences, behaviour and opinions), as well as from Section C (knowledge of fake news items) were described. In the next chapter, further discussions, as well as the formulation of appropriate recommendations will be presented.

Chapter 6: Survey results, findings and recommendations

6.1 Introduction

The work presented in Chapter 6 deals with phase four of the design science framework. Phase four is the evaluation phase and states that the artefact (survey instrument) and the results are evaluated according to criteria. In the previous chapter, Chapter 5, the raw results obtained from the survey were presented and in this chapter, the aim is to summarise the results in a more meaningful way that would allow for a set of recommendations to be formulated. An overview of tests performed to test the statistical independence of responses is presented. This will be followed by a summary of the main findings that were inferred from the results in Chapter 5. Finally, a set of recommendations regarding fake news awareness levels will be offered, whereafter the chapter will be concluded with some general remarks.

6.2 Testing whether variables are associated

A basic statistical test to determine whether two variables are associated is Pearson's Chi-square test for independence together with Cramer's V test (Saunders, 2009). A pre-requisite for using these tests is that the data should be numeric and the variables under investigation must be grouped into discrete classes. The data analysed in this research project complies with this requirement and therefore Pearson's Chi-squared tests and Cramer's V tests will be used to verify any existence of association among classes within the variables used in the survey.

6.2.1 The test statistics

In this section, the Pearson's Chi-squared test and Cramer's V metric are briefly introduced and explained.

Pearson's Chi-squared test for independence:

A Pearson Chi-squared test (also referred to as a goodness of fit test) is a statistical measure that is designed to test categorical data for a pattern of outcomes; i.e., whether a random variable follows a certain pattern of outcomes in a population (Wegner, 2020). Stated in another way, it is designed to find out how likely it is that two variables are associated (Saunders, 2009). The technique tests a null hypothesis (there is no significant difference between variable-1 and variable-2) and makes use of observed frequencies and expected frequencies in a contingency table. The observed frequencies are based on sample findings, while the expected frequencies describe the null hypothesis scenario. The outcome of a Chi-squared test is a calculated probability that the data in the contingency table occur only by chance. To perform this calculation, which is called a *p*-value, a Chi-squared value, and the degrees of freedom of the contingency table are needed.

The formula for the Chi-squared value is given as follows:

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i} \tag{6.1}$$

where O_i is the observed frequency and E_i is the expected frequency.

The expected frequency (E_i) is computed as

$$E_i = \frac{row\ total_i\ x\ column\ total_i}{grand\ total} \tag{6.2}$$

where the row, column and grand totals are obtained from the contingency table.

The *p*-value is more complex to compute and is calculated based on the sample data and the type of test being done (lower-tailed test, upper-tailed test, or two-sided test). These values are normally calculated by statistical software packages or alternatively, can be looked up in a "Chi-square critical values table" (Wegner, 2020). A probability of 0.05 means that there is only a 5% chance that the data in the contingency table occurred only by chance. This means that a *p*-value > 0.05 implies that the variables are independent and that there is no association (Saunders, 2009).

The degrees of freedom are simply calculated as the number of rows minus one, times the number of columns minus one. This can be expressed as

$$(r-1)(c-1) \tag{6.3}$$

To conclude this brief introduction of the Pearson's Chi-squared statistic, Table 6.1 presents an example of a contingency table in the context of this study. In this example, $r = c = 2$.

Table 6.1 Example of a contingency table.

	Fake News	**Real News**	**Total**
Male	No. of males who classify the news article as Fake (x_1)	No. of males who classify the news article as Real (x_2)	$x_1 + x_2$
Female	No. of females who classify the news article as Fake (y_1)	No. of females who classify the news article as Real (y_2)	$y_1 + y_2$
Total	$x_1 + y_1$	$x_2 + y_2$	$x_1 + x_2 + y_1 + y_2$

The tests for independence and possible association of variables in this study were based on the Pearson Chi-squared test and *p*-values as explained above.

Cramer's V

According to Saunders (2009), it is common practice to include the value of the Cramer's V statistic in the Person Chi-squared results. Whereas the Pearson Chi-squared value gives the probability that data occurred by chance, the Cramer's V statistic measures the association between two variables within a contingency table on a scale from 0 to 1. No association is represented by 0 while a perfect association is represented by 1. The formula to compute the Cramer's V statistic is given as

$$V = \sqrt{\frac{\chi^2/n}{\min(c-1, r-1)}} \tag{6.4}$$

where χ^2 is derived from the Pearson Chi-squared test, n is the total of observations (the sample size), and c and r are the number of columns and number of rows, respectively, in the contingency table.

The Cramer's V statistic is used in this study, together with the Pearson Chi-squared test to determine if there is any association between variables. These results are highlighted below.

6.2.2 Results of independence tests

In this section, an explanation of the variables used to test for independence followed by the results of the Pearson Chi-squared test and Cramer's V values are given.

Variables tested for association

The main objective of the study was to determine the level of awareness of fake news amongst students. This implies that the classification of news stories as being fake or real played a significant role in the survey and warranted a more in-depth analysis. The classification variable of news stories (real or fake) was therefore chosen as the primary variable to test for independence or possible association with other variables. The other variables used in the independence tests were Gender, Age and Faculty. The variables Gender and Faculty are by nature represented as categories (i.e., male, female, and the various faculties). The Age variable does not have natural categories (discrete classes) and to test whether there is any association based on the responses from younger *vs* older students, an age categorisation had to be implemented. Students aged 22 and younger made up the first (young students) group while students 23 years and older were classified as the second (older students) group. The cut-off age of 22 years was chosen as students in this age group typically represent undergraduate students, while the other group consists mainly of postgraduate students.

For explanatory purposes, only the first contingency table (explained in Table 6.1), with regard to the fake or real classification for news article one, is presented, together with a table of all the *p*-values and Cramer's V value for the ten news stories that were classified. The results of the other contingency tables (not shown here) were provided by the NWU's Statistical Consulting Services.

Results for the AGE variable

The contingency table for news article one used in the calculation of the *p*-value associated with the Pearson Chi-squared metric and the Cramer's V value is presented in Table 6.2

Table 6.2 Contingency table for Age (younger vs older) with respect to news article ONE.

	Fake News	**Real News**	**Total**
Younger Students	86	21	107
Older Students	62	14	76
Total	148	35	183

The construction of the contingency table in Table 6.2 is interpreted as follows: There were 183 students in total; 107 were classified as younger students (22 years of age and younger); and 76 were classified as older students (23 years and older). Of the 107 young students, 86 classified news article one as fake news and 21 classified news article one as real news. Of the 76 older students, 62 classified news article one as fake news and 14 classified news article one as real news. As explained earlier, these figures are then used to compute the *p*-values from the Pearson Chi-squared statistic as well as the Cramer's V value. For news article one, the *p*-value is 0.838 and Cramer's V value is 0.015. Table 6.3 contains these statistics for all ten news articles.

Table 6.3 Independence test results for AGE (younger students vs older students).

News article	***p*-value from Pearson's Chi-square value**	**Cramer's V value**
1	0.838	0.015
2	0.291	0.078
3	0.227	0.089
4	0.402	0.062
5	0.144	0.108
6	0.703	0.028
7	0.641	0.034
8	0.794	0.019
9	0.614	0.037
10	0.031	0.160

The results in Table 6.3 show that there is no statistically significant association between the two age groups and how they classified all the news articles. All the *p*-values are significantly greater than 0.05 (except for news article 10) while the Cramer's V statistic values are close to 0. The variables are therefore deemed to be independent.

Results for the GENDER variable

The contingency table for news article one used in the calculation of the *p*-value associated with the Pearson Chi-squared metric and the Cramer's V value is presented in Table 6.4

Table 6.4 Contingency table for Gender (male vs female) with respect to news article ONE.

	Fake News	**Real News**	**Total**
Female	48	9	57
Male	98	24	122
Total	146	33	179

The construction of the contingency table in Table 6.4 is interpreted as follows: There were 179 students in total (this is less than the 183 in Table 6.2 as some of the respondents choose not to indicate their gender); 57 were classified as female and 122 were classified as male; of the 57 female students, 48 classified news article one as fake news and 9 classified news article one as real news. Of the 122 male students, 98 classified news article one as fake news and 24 classified news article one as real news. The *p*-value and Cramer's V value are 0.533 and 0.047 for news article one, respectively. Table 6.5 contains the statistics for all ten news articles.

Table 6.5 Independence test results for GENDER (male vs female).

News article	***p*-value from Pearson's Chi-square value**	**Cramer's V value**
1	0.533	0.047
2	0.833	0.016
3	0.812	0.018
4	0.832	0.016
5	0.127	0.114
6	0.218	0.092
7	0.735	0.025
8	0.732	0.026
9	0.666	0.032
10	0.605	0.039

The two discrete groups (male and female) within the gender variable are again deemed to be independent, as can be seen from the values in Table 6.5. All the *p*-values are significantly greater than 0.05 while the Cramer's V statistic values are close to 0.

Results for the FACULTY variable

The contingency table for news article one used in the calculation of the *p*-value associated with the Pearson Chi-squared metric and the Cramer's V value is presented in Table 6.6

Table 6.6 Contingency table for Faculty with respect to news article ONE.

	Fake News	Real News	Total
Economic and Management Sciences	31	7	38
Education	20	5	25
Engineering	21	7	28
Health Sciences	16	3	19
Humanities	17	1	18
Law	7	1	8
Natural and Agricultural Sciences	36	11	47
Total	148	35	183

The construction of the contingency table in Table 6.6 is interpreted as follows: There were 183 students in total; 38 from Economic and Management Sciences, 25 from Education and so on. Of the 38 students from Economic and Management Sciences, 31 classified news article one as fake news and 7 classified news article one as real news. Each of the remaining faculties in Table 6.6 is interpreted in the same manner. The *p*-value and Cramer's V value are computed as 0.716 and 0.142 for news article one, respectively. Table 6.7 contains the statistics for all ten news articles.

Table 6.7 Independence test results for FACULTY (different faculties).

News article	*p*-value from Pearson's Chi-square value	Cramer's V value
1	0.716	0.142
2	0.990	0.068
3	0.314	0.197
4	0.317	0.196
5	0.120	0.235
6	0.205	0.215
7	0.254	0.206
8	0.204	0.215
9	0.494	0.172
10	0.184	0.219

Table 6.7 shows that all the *p*-values are greater than 0.05. Although the Cramer's V values are slightly higher than those of the Age and Gender values, it is still relatively close to zero.

It is therefore reasonable to accept that the classification of news articles as fake or real is not dependent on the faculty where the respondent is a student.

To summarise the results presented in this section, the following conclusion can be made. The classification of news articles is not dependent on the age group, the gender, or the faculty of the respondent. In a more formal statistical manner, it can be concluded that for each of the three variables (age, gender, and faculty), the null hypothesis (i.e., there is no association between age, gender, faculty, and news article classification) can be accepted at the 5% level of significance.

6.3 General findings inferred from the survey

In this section, the raw results presented in Chapter 5 will be summarised as general findings that emerge from the survey.

Finding 1: Based on the work presented in the preceding section, there is no association between categorical variables such as age, gender and faculty, and the classification of news articles as being real or fake. How news articles are evaluated by students does not depend on the respondent's age, gender, or field of study.

Finding 2: In general, students use online services (particularly social media) as primary news source. Older technology, such as printed newspapers and magazines are not important news sources. Furthermore, the most popular social media applications used by students are Facebook, WhatsApp and YouTube. It is therefore safe to assume that fake news has a larger impact on social media than on traditional printed news sources.

Finding 3: A fake news awareness characteristic that may be a concern is that 60% of the students are not aware of fact-checking web sites or facilities where news can be verified. This was also notable at faculty level where there is only one faculty (Humanities) where more than 50% of students are aware of these types of facility; in other faculties the percentage of students who are not aware of fact-checking facilities was as high as 79% (i.e., Faculty of Economic and Management Sciences). The problem is further compounded by the fact that of those who indicated that they are indeed aware of fact-checking facilities, more than 40% indicated that they do not use these facilities when they doubt the contents of a news story.

Another aspect linked to fake news awareness behaviour is that only a small minority (7%) of students always reads the contents of a news article to understand the context of the news, instead of drawing conclusions, based on the headline of the story. However, it is encouraging to learn that two thirds of students verify, at least sometimes, the source of a news article (some may also make use of expert opinions). Most of them also verify the date of the news article which may help them to differentiate between fake and real news.

Finding 4: To obtain insight on how news, and especially fake news spreads, students were asked about their behaviour of sharing news articles. Although just over 50% of the students indicated that they do not share news articles, there was indeed a significant number of students who shared news items, especially weather, crime, sports, and internet memes are popular items for sharing. Knowing the subjects of news items that are regularly shared, fake news awareness campaigns may be more focussed on such news items. The most popular reasons for sharing news items are to inform their friends of something, and for own entertainment reasons.

Finding 5: The main fake news awareness finding relates to the classification of example news articles by students. For explanatory purposes, the statistics on the classification results presented in Chapter 5 are repeated here. Table 6.8 shows the results of the real/fake news classifications by the students.

Table 6.8 Fake news awareness results.

News item	**Fake or Real**	**Number of correct classifications**	**Percentage of correct classifications**
1. Death rate for COVID-19	Fake	149	81%
2. Donating blood	Fake	150	82%
3. Japan dumping contaminated water	Real	136	74%
4.Parrot witnesses murder	Real	91	49%
5. Marijuana can increase risk of psychotic disorders	Real	86	47%
6. Durban metro police were seen loading their van with looted goods.	Fake	46	**25%**
7. Dolphins returned to the canals in Venice	Fake	73	40%
8. Golfer attacked by a hawk	Fake	97	53%
9. South Africa is ranked number one in the murder of women.	Fake	39	**21%**
10. South Africa's late Zulu King Goodwill Zwelithini received a R71.3 million annual salary.	Fake	127	69%

Students were also asked if they would share each one of the news articles. The statistics on students willing to share each one of the ten news stories are presented in Table 6.9. Note that students have indicated that they would share more than one story and the responses reported in Table 6.9 cannot be reconciled with the number of students who took part in the survey.

Table 6.9 News articles that students share.

News item	Fake or Real	Number of students that would share the news story	Percentage of students that would share the news story
1. Death rate for COVID-19	Fake	53	29%
2. Donating blood	Fake	33	18%
3. Japan dumping contaminated water	Real	29	16%
4.Parrot witnesses murder	Real	38	21%
5. Marijuana can increase risk of psychotic disorders	Real	35	19%
6. Durban metro police were seen loading their van with looted goods.	Fake	68	**37%**
7. Dolphins returned to the canals in Venice	Fake	36	19%
8. Golfer attacked by a hawk	Fake	37	20%
9. South Africa is ranked number one in the murder of women.	Fake	62	**34%**
10. South Africa's late Zulu King Goodwill Zwelithini received a R71.3 million annual salary.	Fake	49	27%

An interesting finding from the results in Tables 6.8 and 6.9 is the following. Consider news stories six (SA police joined looting) and nine (SA is number one in the murder of women). These two news items were both fake; and they were both South African news stories. Most students classified them as being real news. Only 25% and 21%, respectively, identified them correctly as fake news (see Table 6.8). Table 6.9 indicates that these two news stories are also the news stories that would be shared by most students with others.

With the above figures in mind, it appears that news stories that are related to your country and your community, and that will have an impact on your own life and circumstances, are more frequently shared and are therefore good candidates for spreading fake news. These types of news article are not easily recognised as fake news. As opposed to domestic stories, news stories that originated outside of South Africa are not easily shared; see for example news story three on Japan and the contamination of water – only 16% of students have indicated that they will share this story. Contemporary stories, such as news stories one and two (COVID-19 and blood donating) are mostly correctly classified as being fake or real. In terms of fake news awareness, the above findings imply that domestic stories that may impact your own life should be treated with care; these news stories should be verified and not thoughtlessly shared with others.

Finding 6: Students had to score the ten news stories as being believable and trustworthy. The results reported in Chapter 5 on these scores indicate that the believability and trustworthy scores are generally in line with the classification of the news story; i.e., when the scores are high (the story is believable and trustworthy) then the classification is real. Conversely, if the scores indicated a low believability and a low trustworthiness, then the classification is fake. This relationship was expected and there is also a strong correlation (98%) between the believability and trustworthiness scores. Although there is a strong correlation between the classification and how the news stories are perceived, it did not help to identify fake news correctly. For example, a student may view a news story as believable (and classify it as real), while the story is in fact fake news – it depends on how students viewed or perceived the news story. A good example of this scenario is the evaluation of news story nine (SA is the number one in murder of women) – most students found this news article believable and trustworthy and therefore classify it as a real news story while it was a fake news story. The use of verification techniques remains an important tool to identify fake news.

Finding 7: Related to Finding 6, it appears that the source of a news article plays a substantial role in how students perceived the believability and trustworthiness of the news article and which in turn leads to the wrong or correct classification of the news article. For example, news story two (not being able to donate blood after receiving the Covid-19 vaccine) was viewed as unbelievable by more than 80% of the students. It was also perceived as untrustworthy by more than 81% of the students. Based on these views the story was classified as fake news. When prompted for reasons for the believability and trustworthy scores, students responded that TikTok videos are not seen as a reliable news source. Similarly, news story nine (SA number one in murder of women) was perceived as believable and trustworthy as the source of the news story was seen as a reliable YouTube news video – this causes students to wrongly classify the fake news story as a real news story.

In this section, seven general fake news-related findings inferred from the raw results presented in Chapter 5 were formulated. These findings will assist with recommendations that can be made to address some if the issues of fake news awareness levels. The recommendations are presented in the next section.

6.4 Recommendations

Fake news and the spreading of misinformation is complex and does not exist in one unique area. This means that the responsibility to address fake news is not limited only to users – or students in the context of this study. There are other role players that also need to combat the fake news phenomenon by implementing sufficient measurements. Owners and developers of social media applications, for example, need to make sure that they have adequate protection against misinformation. Users can make use of specific settings found in the various applications to help guard against fake news and the spreading thereof. Authorities also need to implement appropriate rules and regulations to regulate the spreading of misinformation. The recommendations discussed in this section will, however, only focus on the findings of the empirical study and will not elaborate on the responsibilities of other stakeholders, such as social media companies and governments.

The purpose of the survey was to evaluate the awareness of fake news and the spreading of such news amongst students. The recommendations, based on the findings of the study, are therefore focussed on awareness aspects that will help improve fake news awareness amongst students.

The main and overarching recommendation of the study is that regular fake news awareness campaigns, focussed on students, should be conducted. The aim of such an awareness campaign would be to reach out to students, deliver specific messages to them, and to try and achieve a specific behavioural change in terms of how they see and treat potential fake news stories. The results and findings of this study have indicated that the following recommendations can be made to design a focused fake news awareness campaign that will help students to identify fake news and to handle misinformation appropriately.

- Any fake news awareness programme aimed at students can be designed in a general format, and does not have to take characteristics, such as age, gender, and field of study into account. These characteristics are independent of how students assess news articles.
- Greater emphasis should be placed on online social media applications than on traditional news magazines and printed media. The most popular social media platforms used by students to read news stories are Facebook, WhatsApp and YouTube. A fake news awareness programme should focus on these applications to cover a substantial part of a student population.
- An important aspect of a fake news awareness campaign should be to make students aware of how they can *recognise* fake news. To do this, the awareness programme must include at least the following content.

- Students should be made aware of fact-checking web sites and other facilities where news stories can be checked for validity. The survey has shown that not many students are aware of fact-checking facilities, and even if they are aware of such facilities, they do not use them as a rule.
- The source of a news article plays a significant role in the identification of fake news. Most students would recognise a well-known and valid news source. However, not everybody is aware of fake news sources. The more popular fake news sources may be recognised by students, but additional information on how to identify untrustworthy news sources my help to alleviate the problem of identifying and spreading fake news stories.
- The results of the survey have shown that some students only read the headlines of a news article and then draw conclusions based on that. It is important to make students aware that, whenever there is doubt about the validity of a story, the entire context of the story should be used to draw conclusions; i.e., the news article should be read in its entirety and not just the headlines.
- Students should be informed that, when in doubt, other reputable news sites may be checked to see if they publish the same news article. News stories that are published by more than one trustworthy news outlet are likely to be real news stories.
- In cases where news, or other experts, are available, students should be encouraged to consult with them – especially before sharing a news article which may be a fake news story.
- Some of the news articles presented in the survey to students contain catching images. Fraudsters often make use of catching videos or pictures to attract attention and to add credibility to their stories. Another popular technique is to change (edit) original photos into a picture that is misleading and that does not convey the original message. A fake news awareness programme should point this out and emphasise the importance of scrutinising images and videos and not to accept them blindly.
- Finally, there are some general aspects that students can be made aware of to help them identify fake news. Some of these aspects include disordered or sloppy writing of the news story; the “about us” page of a web site, as well as the “contact us” page often contain information that enables one to decide on the validity of a news website; the web site’s URL should be scrutinised as fake web sites frequently try to mimic real news web sites with their URL, logo, etc.

- A student audience of a fake news awareness programme should also be made aware of certain *behavioural* aspects that relate to the identification and spreading of fake news. Some of these behavioural aspects include the following.
    - An awareness should be created that basic technical options are available in most social media applications to change personal settings to maximum privacy and protection to guard against fake news and dubious news web sites. Students must ensure that they make use of these options and change their social media settings to appropriate levels.
    - Many social media applications have reporting facilities available. Students must be encouraged to report fake news articles so that social media companies can take further steps against perpetrators.
    - Following more people, web sites, etc., and a more diverse group of people will help to create a more balanced view of news articles and will prevent a narrow-minded viewpoint which may impede the ability to identify fake news.
    - An important feature that should be part of every student or social media user's behaviour is to not instinctively share any news story. The above-recommended actions on how to recognise a fake news article should be followed when in doubt. In addition to the fake news recognition steps, the results of the survey also showed that students tend to seek out and agree with information that fits their narrative or what they believe in. This may be extremely dangerous when paired with social media applications, as many of these applications use algorithms to analyse users' behaviour and then recommend content that the user would like to see. These algorithms inadvertently help spreading misinformation by simply providing more and more content that fits the persons narrative, even if it may be inaccurate or fake.
    - Linked to the narrative or belief of a student, are the news articles that are concerned with their own communities. The survey results have indicated that students have wrongly classified fake news stories as real news stories because the topics are related to their country and/or community. In this case, students relied on their opinions of how believable or trustworthy a news story is. An awareness programme should caution students that their believability or trustworthiness opinions do not necessarily imply that news is fake or real news.
    - In general, a good fake news awareness programme must help and guide students to remain sceptical over news and news sources and that they should investigate further when in doubt. Such investigations may then include all, or some of the recommendations listed in this section.

The list of recommendations provides some guidelines for students to help identify and prevent the spread of misinformation – the core of the recommendations may be summarised as maintaining a critical mindset when dealing with potential fake news and the spreading of such news.

The recommendations listed in this section are based on the results and findings of the survey and the empirical study and do not make provision for recommendations pertaining to other stakeholders who may also play a role in the fight against fake news and the spreading of fake news.

6.5 Summary

The content of Chapter 6 formed part of phase four (evaluation phase) of the design science framework and the main purpose of the chapter was to summarise the results of the empirical work in a more meaningful way that would allow for a set of recommendations to be formulated. The chapter consists of three main sections; i.e., a section that details some of the statistical independence tests that were performed, a summary of the main findings, and finally, a set of recommendations that may assist in raising fake news awareness levels.

In the next chapter, the study will be concluded by showing how the initial set of research objectives has been achieved.

Chapter 7: Conclusion

7.1 Introduction

Chapter 7 is the closing chapter of the study in which the final analysis of how the objectives, formulated in Chapter 1, have been achieved is presented. The study contributions, limitations and further research opportunities are also highlighted.

The research project was performed using the *design science research* (DSR) methodology and the framework presented by Vaishnavi and Kuechler (2004) was used as a guideline for the study. The framework consists of five phases and the seven chapters of this research study were structured in such a way that the five DSR phases were covered appropriately. The framework was presented and explained in Chapter 2 and is repeated here (see Table 7.1) for completeness and reference reasons.

Table 7.1 The DSR framework (Vaishnavi and Kuechler, 2004).

Phase	Description	Study chapter
Awareness of problem	Awareness may be drawn from multiple sources, such as new developments in industry, a reference discipline, and reading in an allied discipline. Output: A formal or informal proposal for the new research effort.	**Chapter 1** – Problem statement that contains a formal research proposal. **Chapter 3** – A literature study serves as additional motivation for the proposal.
Suggestion	Suggestion follows the proposal and is connected to it. Output: A tentative design.	**Chapter 1** – The problem statement also proposed a solution, as well as a tentative design. **Chapter 2** – The adoption of a formal design science research methodology contributes to the design of the study. **Chapter 3** – A literature study serves as additional motivation for the design.
Development	The tentative design is implemented; techniques for implementation vary depending on the artefact to be constructed. Output: An implemented artefact.	**Chapter 4** – The development of a measuring instrument and the application thereof in **Chapter 5** constitute an implemented artefact.
Evaluation	Evaluation of the artefact according to criteria. Output: Deviations from expectations, both quantitative and qualitative, tentatively explained.	**Chapter 6** – The results, findings and recommendations will cover the evaluation of the artefact.

Conclusion	Is the result satisfactory; i.e., although there may still be deviations, is the result acceptable? Output: A 'good enough' artefact.	**Chapter 7** – The conclusion will show whether a 'good enough' artefact was created.

In the next section, the achievement of the research objectives of the study will be evaluated. It will also be shown how the different objectives and chapters fit into the DSR phases, as presented in Table 7.1. Furthermore, a set of DSR guidelines (Hevner *et al*., 2004), as presented in Chapter 2, will be discussed briefly to show that the study was indeed performed in a well-structured manner.

7.2 Evaluation of research objectives

In Chapter 1, the problem statement of the research study was formulated as the following research question: "*To what extent can fake news awareness levels amongst students empirically be determined?*" This research question was then translated into a primary research objective which was to evaluate the fake news awareness levels of a selected group of university students. To accomplish the primary research objective, a list of five secondary research objectives was compiled. These secondary research objectives were as follows:

- Conduct a literature review on the various characteristics of fake news;
- Design and develop a measuring instrument to determine current fake news awareness levels of a selected group of students;
- Conduct a survey (amongst the selected group of students) to obtain the required and relevant data regarding their perceptions on fake news;
- Analyse the results of the survey using appropriate techniques; and
- Draw conclusions and make appropriate recommendations.

A summary of how the five research objectives were achieved using the DSR methodology follows below.

Conduct a literature review on the various characteristics of fake news.

The first objective was addressed in Chapter 3. A comprehensive literature study was documented in this chapter and included the following aspects of fake news. The concept of fake news was defined in Section 3.2 while Sections 3.3 and 3.4 focused on why (the motives) people tend to spread fake news and the methods they use to do this, respectively. The adverse effect and impact of fake news on persons, communities and businesses were discussed in Section 3.5, followed by methods for combatting the spreading of misinformation in Section 3.6. Finally, the chapter was concluded by referencing several existing and related studies on the topic of fake news.

The objective of performing a relevant and appropriate literature review was achieved and documented in Chapter 3. The literature review served as an awareness, background and motivation step and the chapter therefore addressed phase 1 of the DSR framework namely "A*wareness of the problem*". In Chapter 1, in which the problem of contextualisation was dealt with, the awareness phase of the DSR framework was also addressed.

Design and develop a measuring instrument to determine current fake news awareness levels of a selected group of students.

The second research objective is concerned with the design and development of a measuring instrument that can be used to determine fake news awareness levels of a selected group of students. However, to be able to do this, it is necessary to first do a tentative design of how the research project will be performed. This implies that phase 2 of the DSR methodology (i.e., the *Suggestion* phase) must be addressed. The suggestion phase is directly linked to the awareness phase and details the design of the entire study. The background and motivation for the design were dealt with in Chapter 1 (problem contextualisation) and Chapter 3 (Literature review). The core of the suggestion phase is, however, contained in Chapter 2 where the research design of the entire study was described. In Chapter 2, a brief overview of different research paradigms was presented and it was explained in detail how the chosen design science research methodology was utilised. Phase 2 (*Suggestion*) of the DSR methodology was therefore addressed in Chapter 2, while additional support and motivation for the phase were offered in Chapters 1 and 3.

To address the second research objective mentioned above, the development of the survey instrument was described in Chapter 4. The chapter consists of two main sections, namely Section 4.2 (Development of the questionnaire) and Section 4.3 (Pilot study). The discussion on the development of the questionnaire included the types of questions used (Section 4.2.1), the sampling method used to recruit and involve participants (Section 4.2.3) and how the survey instrument was administered during the survey (Section 4.2.3). A pilot study was conducted to ensure that the questionnaire was indeed an acceptable measuring instrument and to verify that the methodology used during the survey was acceptable and appropriate. In Section 4.3.1, the participants of the pilot study were described, while the results obtained from the pilot study were discussed in Section 4.3.2. Following the pilot study, several improvements were made to the questionnaire, and these were detailed in Section 4.3.3.

The objective to design and develop an appropriate measuring instrument to determine the fake news awareness levels of a selected group of students was therefore achieved and documented in Chapter 4. The design and development of the measuring instrument (artefact) therefore addressed phase 3 of the DSR framework, namely "*Development*".

Conduct a survey (amongst the selected group of students) to obtain the required and relevant data regarding their perceptions on fake news.

To address the third research objective, a survey was conducted amongst a selected group of students. This application of the artefact (survey instrument) was described in Chapter 5. The administering of the actual survey was described in Section 5.2. In Section 5.3, the demographic details of the participants were presented while in Section 5.4, the raw results obtained from all the respondents (i.e., a count of results as recorded and not the analysed results) were reported.

The research objective to conduct a survey was therefore achieved and documented in Chapter 5. The application of the survey constituted an implemented artefact and (together with Chapter 4) addressed phase 3 of the DSR framework, namely "*Development*".

Analyse the results of the survey using appropriate techniques.

The penultimate research objective was achieved by analysing the results of the survey and documenting a set of findings that was derived from the survey data in Chapter 6. Detailed statistical independence tests among certain selected categorical variables were detailed in Section 6.2. A formal set of findings inferred from the raw results in Chapter 5 was presented in Section 6.3.

The research objective to appropriately analyse the results obtained during the survey was therefore achieved and documented in Chapter 6. The evaluation of survey results and the identification of specific findings addressed phase 4 of the DSR framework, namely "*Evaluation*".

Draw conclusions and make appropriate recommendations.

The final research objective was to draw conclusions and make appropriate recommendations. This objective was achieved in the second part of Chapter 6, as well as in this current chapter, Chapter 7. In Section 6.4, a comprehensive list of recommendations that were based on the findings (also presented in Chapter 6, Section 6.3) was presented. In this current chapter, Chapter 7, the artefact has been shown to be a "good" artefact and that all the research objectives formulated in Chapter 1 have been achieved successfully.

The research objective to draw conclusions and make appropriate recommendations was therefore achieved and documented in Chapter 6 and Chapter 7. The conclusion of the study and the evaluation of the artefact addressed the final phase, (phase 5) of the DSR framework, namely "*Conclusion*".

To summarise the discussion on research objectives, it may be concluded that all research objectives set forth in Chapter 1 were successfully achieved and addressed, guided by the DSR methodology. It is also clear that the achievement of the research objectives implies automatically that the research question, "*To what extent can fake news awareness levels amongst students empirically be determined?*" is answered in a positive manner – it is indeed possible to determine, with reasonable accuracy, fake news awareness levels empirically. Further specific contributions will be highlighted in Section 7.3.

Design science research guidelines used in the study.

In addition to the five phases of the DSR framework that were utilised in this study, a set of seven design science research guidelines (Hevner *et al*., 2004) was also used to ensure that the research process was performed in a well-structured manner. The seven guidelines were presented in Chapter 2 and are repeated here, together with an indication of how the study complied with them.

Guideline 1 - Design an artefact. The main goal of design science research is to produce a viable artefact. Such an artefact may be in the form of a construct, a representation, a technique, a model, or a method.

In this study a viable artefact was designed and developed. The artefact was in the form of a survey instrument that was used to determine the fake news awareness levels of a selected group of students.

Guideline 2 - Relevance of the problem. The essential requirement of design science research is to address a meaningful and relevant business problem and create a technology-based solution.

The problem addressed in this study was shown to be highly relevant. The spreading of fake news and misinformation is a contemporary problem that has a substantial impact on individuals, businesses, and communities. In Chapter 1, the problem was contextualised, while in Chapter 3, additional motivation for the relevance of the topic was provided by presenting a comprehensive literature review.

Guideline 3 - Design evaluation. The artefact must have specific characteristics; i.e., it must comply with utility, quality and efficacy requirements and these requirements must be demonstrated using appropriate evaluation methodologies.

The development of the artefact (survey instrument) complied with utility, quality, and efficacy requirements as was detailed in Chapter 4. In this chapter, a detailed overview

of how the survey instrument was developed and then tested by means of a pilot study before the final implementation was presented.

Guideline 4 - Research contributions. A completed design science research project should offer new contributions. These contributions must be clear and verifiable in terms of the artefact and the methodologies employed.

The study offered several contributions (which will be highlighted in a subsequent section). The first contribution is the artefact that can be used to assess fake news awareness levels. Another one of the main contributions is the set of recommendations related to fake news awareness levels. These recommendations were inferred from the results of the developed artefact and contribute to the management and handling of spreading misinformation.

Guideline 5 - Research rigour. This guideline requires the application of rigorous methods in both the construction of the artefact, as well as the evaluation thereof.

Rigorous methods were applied in both the construction of the artefact as well as in the evaluation thereof. In Chapter 2, the formal scientific process that was followed to conduct the research was detailed, while in Chapter 4, the actual development and testing of the artefact were outlined. The evaluation was performed in Chapter 6, where the results were analysed and translated into practical and useable recommendations and guidelines for raising fake news awareness levels.

Guideline 6 - Design as a search process. The importance of recognising the design as a search process is imperative. It implies that the construction of (or search process to construct) an effective artefact should use all available resources while complying with the laws dictated by the problem environment.

The construction of the artefact was based on a comprehensive literature survey (i.e., questions used in the questionnaire were motivated from the literature). The design and sampling method were based on scientific and documented procedures and the artefact was tested properly during a pilot test to ensure that it complies with the problem environment.

Guideline 7 - Communication of research. The last guideline stipulates that the communication of the design science research project must be presented in an effective manner. Different audiences exist and communication should provide for both technology- orientated, as well as management-orientated people.

The research is communicated through this dissertation. The contents are both technology-orientated (design of artefact and analysis of data), as well as management-orientated (the proposed recommendations).

Finally, the study achieved all objectives, was carried out using an accepted design science research methodology and guided by several guidelines, as recorded in the literature. In the next section, a summary of the contributions made by the study is outlined.

7.3 Contributions of the study

A summary of the contributions of the study is presented below.

- The literature study provided an organised and structured central source of fake new information.
- A novel measuring instrument was designed, developed, and applied to evaluate the fake news awareness levels of a selected group of students.
- As a result of the study, a set of unique findings pertaining to students and their connection with fake news was formulated. Some of the findings include the independence of features, such as age, gender and field of study, how students consume and share news stories, the influence of prior beliefs on the perception of news stories, the role of perceived believability and trustworthiness of news stories, etc.
- The study contributes a wide-ranging list of recommendations that can be implemented to raise fake news awareness levels. These recommendations are focussed on two main categories; i.e., making students aware of how to *recognise* fake news, and making students aware of certain important *behavioural* aspects.
- The study provided proof that fake news awareness levels can be determined empirically with reasonable accuracy.
- Finally, the study implemented a well-known scientific approach; i.e., the *design science research* methodology, and served as an example of how to utilise this approach to successfully conduct and complete an academic research project.

The contributions are in line with the research objectives set forth in Chapter 1 and confirm the successful completion of the research study. Limitations of the study will be highlighted in the next section.

7.4 Limitations of the study

There may have been an element of social desirability present in the results of the survey. Respondents were obviously aware that the survey evaluates their knowledge of fake news stories which may have caused them to be extra alert when responding to questions or to respond in an untruthful manner.

Due to the snowball sampling technique used in the study, little control on the number, as well as the distribution of students was possible. This means that some of the faculties had a very low participation while one of the faculties (Theology) had no participants at all.

To keep the survey instrument within a reasonable length, only ten news articles were included for classification by participants. This limited not only the number of news stories, but also the diversity of news topics that could be used.

7.5 Future work

Several avenues for future research exist. Firstly, the problem of underrepresentation may be eliminated by experimenting with other sampling techniques to ensure that sufficient participants are recruited from all faculties. This may also assist with a more detailed comparison among students in different fields of study. Secondly, the use of a more diverse and greater number of news articles may further enhance the survey process and may deliver more insightful results. Finally, the survey instrument (or a similar questionnaire) may be used to evaluate the effectiveness of fake news awareness campaigns.

7.6 Summary

Chapter 7 is the concluding chapter of this research project in which the final analysis of the research objectives formulated in Chapter 1 was presented and in which it was shown how they were addressed and achieved by employing the design science research methodology. Limitations of the study and possible research opportunities were also outlined.

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Appendix A – Survey instrument

Fake news awareness survey

This questionnaire is for a university research study that is trying to understand how fake news spreads on social media platforms and whether university students are able to correctly identify fake news. The information you provide in this survey will be completely confidential. The questionnaire consists of three sections. Section A collects demographic information, section B consists of general questions and news preferences and section C is a fake news awareness survey. The questionnaire should take 10-15 min to complete. Please answer the questions below to the best of your ability. Your completion and return of the survey will be considered as your consent and agreement to participate in this research study. Thank you in advance for your time and participation.

Section A - Demographic details

1. Age

_____

2. Gender

Select only one option

- ◯ Male
- ◯ Female
- ◯ Prefer not to answer

3. Field of study (e.g., BSc, BCom, etc.)

_____

4. Faculty

Select only one option

- ◯ Economic and Management Sciences
- ◯ Education
- ◯ Engineering
- ◯ Health Sciences
- ◯ Humanities
- ◯ Law
- ◯ Natural and Agricultural Sciences
- ◯ Theology

Section B - General news preferences

The questions in Section B collect personal information and preferences. This information will assist with understanding how fake news is perceived by social media users.

1. 1. Please rate the order of importance of primary news sources as it applies to you (1 being least important, 5 being most important).

Select only one option per row.

	1	2	3	4	5
Television	◯	◯	◯	◯	◯
Social media	◯	◯	◯	◯	◯
Online journalism	◯	◯	◯	◯	◯
Newspapers	◯	◯	◯	◯	◯
Magazines	◯	◯	◯	◯	◯

2. What social media applications do you use for news?

Tick all that apply.

- [ ] Facebook
- [ ] Snapchat
- [ ] YouTube
- [ ] Instagram
- [ ] Twitter
- [ ] Reddit
- [ ] LinkedIn
- [ ] TikTok
- [ ] WhatsApp
- [ ] Other: _____

3. Are you aware of the fact-checking movement in journalism, which includes web sites, such as PolitiFact, Factcheck.org, and the Washington Post FactChecker?

Select only one option.

- ◯ Yes
- ◯ No (If No, skip question 4)

4. How often do you make use of fact-checking web sites to verify information that you have received or read?

Select only one option.

- ◯ Never
- ◯ Rarely
- ◯ Only when I doubt information
- ◯ Sometimes
- ◯ Always

5. When you have doubts about news that you have read, do you check the source of the news content and other news sources?

Select only one option.

- Never
- Rarely
- Sometimes
- Always

6. Do you always read the content of the story and not just the headlines?

Select only one option.

- Never
- Rarely
- Only when I doubt information
- Sometimes
- Always

7. Do you check the date of the news stories to make sure the story is relevant and up to date?

Select only one option.

- Never
- Rarely
- Only when I doubt information
- Sometimes
- Always

8. Do you crosscheck news stories with other media institutions?

Select only one option.

- Never
- Rarely
- Only when I doubt information
- Sometimes
- Always

9. Do you ask expert opinions on a given topic to make sure the news story is accurate?

Select only one option.

- ◯ Never
- ◯ Rarely
- ◯ Only when I doubt information
- ◯ Sometimes
- ◯ Always

10. What news topics have you recently shared with others if you do share news?

Tick all that apply.

- ☐ I do not share news (Skip question 11)
- ☐ Weather
- ☐ Crime
- ☐ Traffic
- ☐ Prices and goods
- ☐ Government and politics
- ☐ School
- ☐ Jobs and unemployment
- ☐ Sports
- ☐ Celebrity gossip
- ☐ Religion
- ☐ Internet culture/memes
- ☐ Community activities
- ☐ Other: _____

11. Why do you choose to share news with others?

Tick all that apply.

- ☐ To let my friends/followers know about something I think they would like
- ☐ To bring attention to a larger cause in community or world
- ☐ To help change the opinion of my friends/followers
- ☐ To entertain my friends/followers
- ☐ To get a response or opinion from my friends/followers
- ☐ Just to keep my online activity active
- ☐ To entertain myself
- ☐ To gain likes
- ☐ Other: _____

Section C - Fake news awareness survey

Section C consists of 10 questions, each containing either a real or a fake news story. Identify whether each news story is fake or real. You will also be asked how believable and trustworthy the news is and why you believe the news to be fake or real. Please answer to the best of your ability.

News Article 1: This is an Instagram post, claiming that the death rate for COVID-19 vaccinated people is higher than that of unvaccinated people.

Do you believe news article 1 is real or fake news?

Select only one option.

- ◯ Real
- ◯ Fake

How did you come to the conclusion? (e.g., verified profile, well-known news source, have heard of the news before, previous beliefs, sounds believable)

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How believable did you find news article 1?

Select only one option.

- ◯ Very believable
- ◯ Believable
- ◯ Unbelievable
- ◯ Very unbelievable

How trustworthy did you find news article 1?

Select only one option.

- ◯ Very trustworthy
- ◯ Trustworthy
- ◯ Untrustworthy
- ◯ Very untrustworthy

News Article 2: A TikTok video claiming that after receiving the COVID-19 vaccine, you will be unable to donate blood or plasma (in the online questionnaire, respondents were able to view the video)

Do you believe news article 2 is real or fake news?

Select only one option.

- ◯ Real
- ◯ Fake

How did you come to the conclusion? (e.g., verified profile, well-known news source, have heard of the news before, previous beliefs, sounds believable)

How believable did you find news article 2?

Select only one option.

- ◯ Very believable
- ◯ Believable
- ◯ Unbelievable
- ◯ Very unbelievable

How trustworthy did you find news article 2?

Select only one option.

- ◯ Very trustworthy
- ◯ Trustworthy
- ◯ Untrustworthy
- ◯ Very untrustworthy

News Article 3: This is a news article, announcing that Japan will dump contaminated water into the sea.

Japan has announced it will release more than 1m tonnes of contaminated water from the wrecked Fukushima nuclear power plant into the sea, a decision that has angered neighbouring countries, including China, and local fishers.

Official confirmation of the move, which came more than a decade after the nuclear disaster, will deal a further blow to the fishing industry in Fukushima, which has opposed the measure for years.

The prime minister, Yoshihide Suga, told a meeting of ministers on Tuesday that the government had decided that releasing the water into the Pacific Ocean was the "most realistic" option, and "unavoidable in order to achieve Fukushima's recovery".

The plant's operator, Tokyo Electric Power [Tepco], and government officials say tritium, a radioactive material that is not harmful in small amounts, cannot be removed from the water, but other radionuclides can be reduced to levels allowed for release.

Do you believe news article 3 is real or fake news?

Select only one option.

- ◯ Real
- ◯ Fake

How did you come to the conclusion? (e.g., verified profile, well-known news source, have heard of the news before, previous beliefs, sounds believable)

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How believable did you find news article 3?

Select only one option.

- ◯ Very believable
- ◯ Believable
- ◯ Unbelievable
- ◯ Very unbelievable

How trustworthy did you find news article 3?

Select only one option.

- ◯ Very trustworthy
- ◯ Trustworthy
- ◯ Untrustworthy
- ◯ Very untrustworthy

News Article 4: This is a news article about a woman getting life in prison for murder witnessed by a parrot

SEARCH

AMAZIN' BUT TRUE
A NEW YORK METS BASEBALL PODCAST

NEW YORK POST

Woman gets life in prison for murder witnessed by parrot

By Associated Press

August 29, 2017 | 8:36am

Shutterstock

WHITE CLOUD, Mich. — A Michigan woman has been sentenced to life in prison for the shooting death of her husband in a crime apparently witnessed by the man's pet parrot.

Forty-nine-year-old Glenna Duram of Sand Lake learned her sentence Monday after a jury found her guilty of first-degree murder and a felony firearm charge last month.

SEE ALSO

'Don't f—ing shoot': Does this parrot know who killed his owner?

Forty-six-year-old Martin Duram was shot five times in May 2015. Glenna Duram suffered a head wound in what prosecutors said was a suicide attempt, but survived.

Martin Duram's ex-wife, Christina Keller, has said that after the slaying, the pet parrot, Bud, repeated "don't (expletive) shoot" in Martin Duram's voice. Keller took ownership of the bird after Martin Duram's death.

Glenna Duram's attorney plans to appeal.

Do you believe news article 4 is real or fake news?

Select only one option.

- ◯ Real
- ◯ Fake

How did you come to the conclusion? (e.g., verified profile, well-known news source, have heard of the news before, previous beliefs, sounds believable)

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How believable did you find news article 4?

Select only one option.

- ◯ Very believable
- ◯ Believable
- ◯ Unbelievable
- ◯ Very unbelievable

How trustworthy did you find news article 4?

Select only one option.

- ◯ Very trustworthy
- ◯ Trustworthy
- ◯ Untrustworthy
- ◯ Very untrustworthy

News Article 5: This is a Twitter post claiming that marijuana can increase the risk of schizophrenia and psychotic disorders

Do you believe news article 5 is real or fake news?

Select only one option.

- ◯ Real
- ◯ Fake

How did you come to the conclusion? (e.g., verified profile, well-known news source, have heard of the news before, previous beliefs, sounds believable)

How believable did you find news article 5?

Select only one option.

- ◯ Very believable
- ◯ Believable
- ◯ Unbelievable
- ◯ Very unbelievable

How trustworthy did you find news article 5?

Select only one option.

- ◯ Very trustworthy
- ◯ Trustworthy
- ◯ Untrustworthy
- ◯ Very untrustworthy

News article 6: This YouTube video claiming Durban metro police were seen stealing looted goods and driving off during the Durban protests (in the online questionnaire, respondents were able to view the video).

Do you believe news article 6 is real or fake news?

Select only one option.

- ◯ Real
- ◯ Fake

How did you come to the conclusion? (e.g., verified profile, well-known news source, have heard of the news before, previous beliefs, sounds believable)

How believable did you find news article 6?

Select only one option.

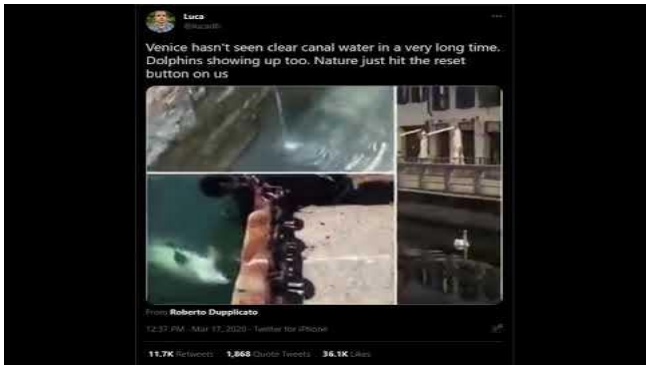
- Very believable
- Believable
- Unbelievable
- Very unbelievable

How trustworthy did you find news article 6?

Select only one option.

- Very trustworthy
- Trustworthy
- Untrustworthy
- Very untrustworthy

News Article 7: This is a Twitter video, claiming dolphins returned to the canals inVenice during the pandemic lockdown (in the online questionnaire, respondents were able to view the video).



Do you believe news article 7 is real or fake news?

Select only one option.

- ◯ Real
- ◯ Fake

How did you come to the conclusion? (e.g., verified profile, well-known news source, have heard of the news before, previous beliefs, sounds believable)

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How believable did you find news article 7?

Select only one option.

- ◯ Very believable
- ◯ Believable
- ◯ Unbelievable
- ◯ Very unbelievable

How trustworthy did you find news article 7?

Select only one option.

- ◯ Very trustworthy
- ◯ Trustworthy
- ◯ Untrustworthy
- ◯ Very untrustworthy

News Article 8: This news article claims that a golfer was attacked by a hawk protecting a golf ball that bounced into its nest.

Do you believe news article 8 is real or fake news?

Select only one option.

- ◯ Real
- ◯ Fake

How did you come to the conclusion? (e.g., verified profile, well-known news source, have heard of the news before, previous beliefs, sounds believable)

How believable did you find news article 8?

Select only one option.

- Very believable
- Believable
- Unbelievable
- Very unbelievable

How trustworthy did you find news article 8?

Select only one option.

- Very trustworthy
- Trustworthy
- Untrustworthy
- Very untrustworthy

News Article 9: This is a video on YouTube featuring the Minister of Social Development from South Africa, who claims that South Africa is ranked number one in the murder of women (in the online questionnaire, respondents were able to view the video).

Do you believe news article 9 is real or fake news?

Select only one option.

- ◯ Real
- ◯ Fake

How did you come to the conclusion? (e.g., verified profile, well-known news source, have heard of the news before, previous beliefs, sounds believable)

How believable did you find news article 9?

Select only one option.

- ◯ Very believable
- ◯ Believable
- ◯ Unbelievable
- ◯ Very unbelievable

How trustworthy did you find news article 9?

Select only one option.

- ◯ Very trustworthy
- ◯ Trustworthy
- ◯ Untrustworthy
- ◯ Very untrustworthy

News article 10: This is a Facebook post, claiming that South Africa's late Zulu King Goodwill Zwelithini received a R71.3 million annual salary

Do you believe news article 10 is real or fake news?

Select only one option.

- Real
- Fake

How did you come to the conclusion? (e.g., verified profile, well-known news source, have heard of the news before, previous beliefs, sounds believable)

How believable did you find news article 10?

Select only one option.

- Very believable
- Believable
- Unbelievable
- Very unbelievable

How trustworthy did you find news article 10?

Select only one option.

- Very trustworthy
- Trustworthy
- Untrustworthy
- Very untrustworthy

Which of the news articles (even if you believe them to be fake), would you have shared with friends/family?

Tick all that apply

- [ ] Death rate for vaccinated people is higher than that of unvaccinated people
- [ ] Japan announced it will dump contaminated water into the sea
- [ ] Woman gets life in prison for murder, witnessed by a parrot
- [ ] Marijuana can increase the risk of schizophrenia and psychotic disorders
- [ ] You can't donate blood or plasma if you have the Covid-19 vaccine
- [ ] Durban metro police were seen loading their van with looted goods
- [ ] Golfer was attacked by a hawk, protecting a golf ball that bounced into its nest
- [ ] Dolphins returned to the canals in Venice, during the pandemic lockdown
- [ ] South Africa is ranked number one in the murder of women
- [ ] South Africa’s late Zulu king Goodwill Zwelithini got a R71.3 million annual salary
- [ ] I would not share any of these news articles

Appendix B – Confirmation of Language Editing

This serves to confirm that I, Isabella Johanna Swart, registered with and accredited as professional translator by the South African Translators' Institute, registration number 1001128, language edited the following dissertation:

Fake news awareness amongst students: an empirical study

by

M van Rheede van Oudtshoorn

Dr Isabel J Swart

Date: 3 November 2022

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