

Pedagogies of play to develop intermediate phase mathematics teachers' metacognitive awareness

E. Potgieter

 [orcid.org/ 0000-0002-7065-964X](https://orcid.org/0000-0002-7065-964X)

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Supervisor: Prof M.S Van der Walt

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Student number: 23423455

STATEMENT

I, the undersigned, hereby declare that the work contained in this dissertation is my own original work and that I have not previously submitted it to any other university for a degree.

A handwritten signature in black ink, appearing to read 'A. Regela', is centered on the page.

Signature

25 November 2019

Date

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PREFACE

Never forget to acknowledge those on your road towards success, but also remember all who crossed your path continuously to help and support you, even in the slightest manner.

I would like to express my sincerest appreciation to the following institutes / persons who helped and encouraged me every step of this journey – to you I am ever grateful!

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"The best journeys answer questions that in the beginning, you didn't even think to ask"

(180 Degrees South)

ABSTRACT

This generic qualitative study with elements of phenomenology aimed to explore and describe intermediate phase mathematics teachers' lived experiences based on the transfer of pedagogy of play (PoP) (referring to puppetry) and the professional development of their metacognitive awareness before, during and after a professional development intervention. The unique research design allowed for the development of an intervention where participants voluntarily engaged in two half-day workshops. The first workshop was an orientation workshop where participants worked collaboratively with the facilitators (myself and my supervisor), to establish what Pedagogy of Play is and how puppetry is nested therein and what metacognitive awareness entails. Although Pedagogy of Play includes various approaches (such as board games and computer games), puppetry was chosen as pedagogical tool, because of a scarcity of research in the Afrikaans and English language of learning and teaching, in the context of mathematics education. Metacognition was modelled and participants were afforded the opportunity to practice and implement metacognitive strategies through reflection. The second workshop followed an adapted lesson study approach where participants planned lessons, wrote puppetry scripts for these lessons and mathematised the content, making mathematics meaningful and accessible to the learners' specific school context. The intervention scaffolded and enhanced participants' metacognitive awareness and Self-Directed Learning (SDL). This study stems from an interpretivist paradigm, allowing for a theoretical framework nested in social constructivism. The theoretical framework allowed for the integration of two research lenses to be implemented when analysing the data and interpreting the results namely (i) third-generation cultural historical activity theory (CHAT) and, (ii) the Rogan and Grayson Model. Findings in this study concluded that PoP can be seen as a useful pedagogical tool, allowing the intermediate phase mathematics learner to communicate increasingly more about content; fostering a positive classroom environment; allowing for a creative space; fostering and potentially enhancing cooperation and group integration and influencing learner attitudes, hence making mathematics fun, meaningful and accessible to all learners.

Keywords:

adapted lesson study; intermediate phase; metacognition; metacognitive awareness; pedagogical content knowledge (PCK); pedagogy of play (PoP); professional development; puppetry; Rogan and Grayson model; self-directed learning (SDL); third-generation cultural-historical activity theory (CHAT).

OPSOMMING

Hierdie studie was generies kwalitatief-fenomenologies van aard en het ten doel gehad om die beleefde ervarings van wiskunde-onderwysers in die intermediêre fase te ondersoek en te beskryf, gebaseer op die oordrag van pedagogie van spel (met verwysing na poppespel) en die ontwikkeling van hul metakognisie bewustheid vóór, tydens en ná 'n intervensie wat as professionele ontwikkeling gedien het. Dié unieke navorsingsontwerp het 'n intervensie moontlik gemaak waar deelnemers vrywillig aan professionele ontwikkeling tydens twee halfdagwerkswinkels deelgeneem het. Die eerste werkswinkel was 'n oriënteringswerkswinkel waar deelnemers saam met die fasiliteerders (ek en my studieleier) gewerk het om vas te stel wat pedagogie van spel is, hoe poppespel daarin ingebed is en wat metakognitiewe bewustheid behels. Alhoewel pedagogie van spel verskillende benaderings insluit (soos bordspeletjies, rekenaarspeletjies, ens.), is poppespel as hulpmiddel gekies aangesien daar min navorsing daaroor in Afrikaans en Engels gedoen is, veral in die intermediêre fase-wiskundekonteks in Suid-Afrika. . Die tweede werkswinkel was gebaseer op 'n aangepaste lesstudiebenadering waar deelnemers lesse beplan het, poppespeldialoë rondom bepaalde wiskunde inhoud geskryf het wat dit betekenisvol en toeganklik maak vir die leerders in dié deelnemers se spesifieke skoolkontekste. Die intervensie het op twee opeenvolgende Saterdag plaasgevind om deelnemers toe te laat om hul poppe in hul onderskeie intermediêre fase-wiskundeklasse voor te stel en kennis wat by beide werkswinkels opgedoen is na hul praktiese onderrig-leer oor te dra. Die intervensie het hul metakognitiewe bewustheid en selfgerigte leer (SGL) gesteun en versterk in die oordrag van hul kennis na hul persoonlike onderrig-leer in die intermediêre fase-wiskundeklaskamer. Hierdie studie spruit vanuit 'n interpretivistiese paradigma wat aanleiding gee tot 'n teoretiese raamwerk gekenmerk deur sosiale konstruktivisme. Die teoretiese raamwerk het gelei tot die integrasie van twee navorsingslense wat gedurende data-ontleding geïmplementeer is, naamlik (i) derde-generasie kultuurhistoriese aktiwiteitsteorie (KHAT), en (ii) die Rogan en Grayson-model. In hierdie studie is bevind dat die pedagogie van spel (met verwysing na poppespel) gesien kan word as 'n nuttige pedagogiese hulpmiddel waardeur die wiskunde-leerder in die intermediêre fase toenemend meer oor inhoud kan kommunikeer; dat poppespel 'n positiewe klaskameromgewing bevorder; 'n kreatiewe ruimte word geskep; die samewerking en groepintegrasie word moontlik bevorder en poppespel bied die potensiaal om die houdings van die leerder te beïnvloed en te verbeter, wat wiskunde aangenaam, sinvol en toeganklik maak vir alle leerders.

Sleutelwoorde:

aangepaste lesstudie; derde-generasie kultuurhistoriese aktiwiteitsteorie (KHAT); intermediêre fase; metakognisie; metakognitiewe bewustheid; pedagogiese inhoudskennis (PIK); pedagogie van spel; professionele ontwikkeling; poppespel; Rogan en Grayson-model; selfgerigte leer (SGL).



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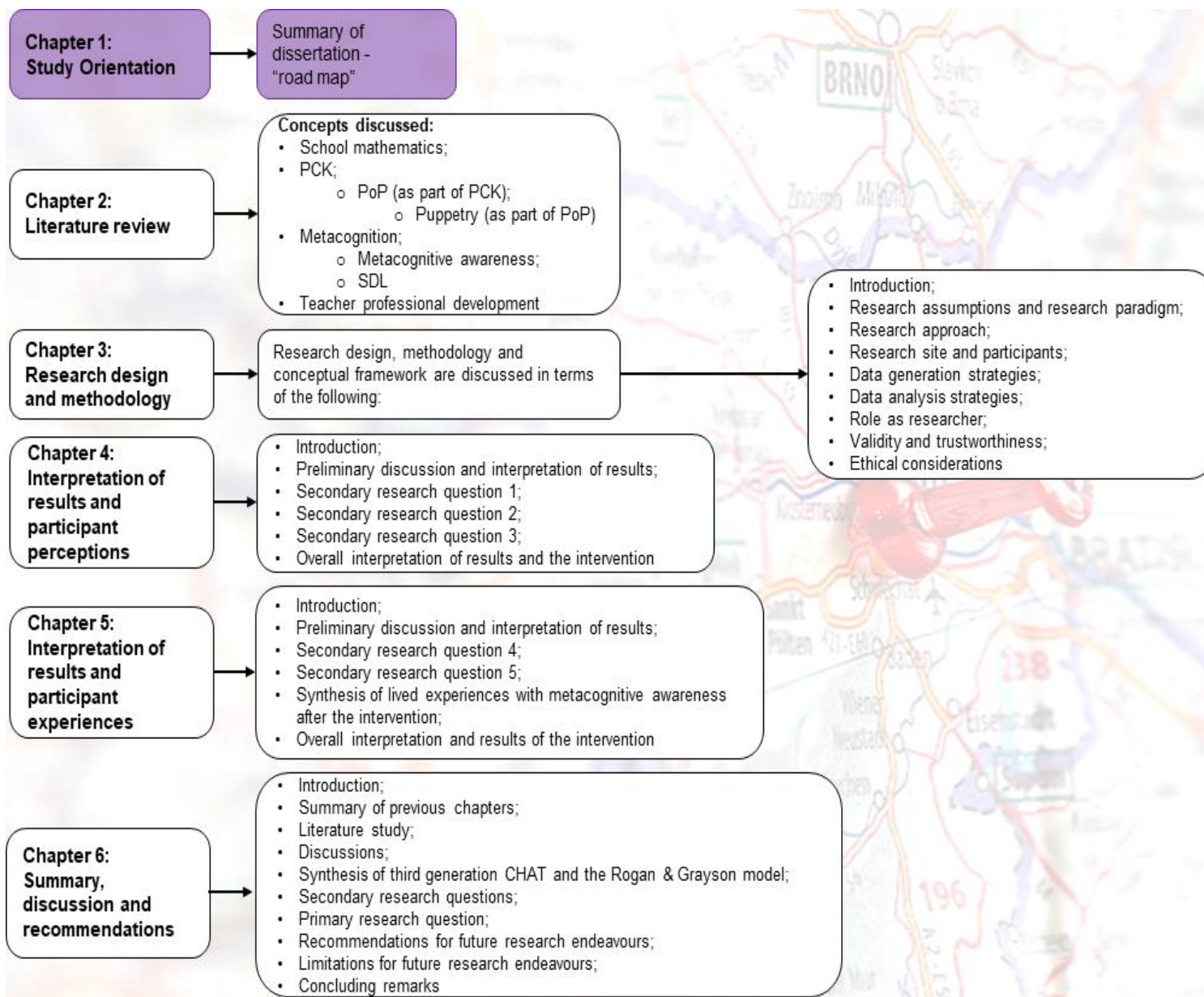
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CHAPTER 1: STUDY ORIENTATION

1.1 RATIONALE OF THIS STUDY

South Africa has undergone rapid reform, specifically relating to the teaching-learning praxis of mathematics education (Molefe, & Brodie, 2010). The changes pertain to teachers' practices influencing learners' contributions and interactions in the mathematics classroom (Molefe & Brodie, 2010). The Department of Education (DoE) (now known as the Department of Basic Education – DBE) was very optimistic in their initial training of South African teachers before the implementation of the Curriculum Assessment Policy Statement (CAPS), but the aim to improve the quality of education by changing the curriculum has led to poor implementation of the changes (Molapo, 2017).

Unfortunately, teachers still tend to rely on the transmission mode of education, where factual knowledge is transmitted, but lacks understanding and practice opportunities where learners can apply new knowledge to new contexts (Saavedra, & Opfer, 2012). Learning 21st-century skills requires 21st-century teaching (Saavedra & Opfer, 2012). Teachers lack the skills in the teaching profession to live up to the expectations of 21st-century teaching – something that can be facilitated through professional development (Osamwonyi, 2016).

According to Flores (2004), professional development does not respond adequately to assist in the changing nature of teaching-learning due to being short term, involving several hours or days of workshops with very few follow-up activities. In contrast to the above argument, Tang, Wong, and Cheng (2016) state that the quantity of professional development interventions does not imply anything unless it is of great quality, addressing the challenges teachers come across. Kennedy (2014) suggests that professional development aimed at improved teaching-learning practices should (i) identify problems central to teaching-learning praxis and (ii) devise a pedagogy assisting teachers to infuse these new ideas into their classrooms. It is essential that teachers are afforded the opportunity to experiment, practise and reflect on these teaching-learning experiences based on the tools an intervention will provide them (Girvan, Conneely, & Tangney, 2016).

I became interested in the professional development of teachers based on relevant literature and how teachers (as learners themselves – lifelong learners) experience professional development workshops with regard to what they have learned in these workshops that they could transfer to their respective mathematics classrooms. In this study, two professional development workshops (henceforth referred to as the intervention) were presented, envisaging the integration of pedagogy of play (PoP) (specifically puppetry) as a component of mathematics teachers' pedagogical content knowledge (PCK) to develop and improve their metacognitive awareness.

Metacognitive awareness during and after the intervention may also positively contribute to teaching-learning experiences in the intermediate phase mathematics classroom, enhancing teachers' self-directed learning (SDL). There seems to be a gap in research in the South African context on mathematics teachers' experiences concerning PoP and metacognitive awareness as an aspect of development of their PCK. No research has been found in the English- and Afrikaans-language literature on these topics.

In light of the above discussion, the specific question was:

What are intermediate phase mathematics teachers' lived experiences based on the transfer of PoP (puppetry) and the development of their metacognitive awareness in the mathematics classroom, as scaffolded by an intervention to enhance their SDL?

To address this question, I investigated the body of scholarship, examining the literature on intermediate phase mathematics teachers, metacognitive awareness, PCK, PoP, puppetry, teacher professional development, and SDL. The lived experiences of the participating intermediate phase mathematics teachers contributed to the understanding of these components' relation to one another as well as the intervention overall.

1.2 INVESTIGATING THE BODY OF SCHOLARSHIP

The following components in the body of scholarship were addressed and can be clarified as follows.

1.2.1 Intermediate phase

In the South African schooling system, this phase refers to learners in Grades 4 to 6 (ages 10 to 12) (DoE, 2011).

1.2.2 Metacognitive awareness

Metacognition allows individuals to "think about their thinking" (Flavell, 1979). Flavell (1979) established that metacognition consists of metacognitive knowledge and self-regulation. According to Balcikanli (2011), Cornoldi (2009) and Ertmer and Newby (1996), metacognitive awareness entails the following: during the learning process, individuals plan to utilise their metacognitive knowledge concerning persons (declarative), tasks (procedural), and strategies (conditional). Personal knowledge refers to knowledge about oneself (and others) as a learner (and teacher) and overall task performance. Task knowledge refers to how one solves the problem or completes the task. Strategic knowledge refers to when, why, how and what teaching-

learning strategy(ies) – available and appropriate - to employ for successful task completion. Self-regulation entails planning, monitoring and evaluation.

Metacognitive knowledge manifests itself in self-regulation. Self-regulation constantly reflects on person, task and strategic knowledge via ongoing planning, monitoring and evaluation throughout the learning process for successful task completion. Furthermore, as the individual (teacher in this case) engages in reflection for, in and on the learning process, additional metacognitive knowledge about the person, task and strategies are gathered, instilling characteristics (of self and of others) in the teacher, which is available when planning, monitoring and evaluating future teaching-learning endeavours. Therefore, the reflection for, in and on this process manifests as metacognitive awareness because of the individual's explicit and implicit awareness of what he or she is doing, how he or she is doing it, and why he or she is doing it, enabling autonomy in learning overall (Balcikanli, 2011; Erskine, 2010; Ertmer, & Newby, 1996).

1.2.3 Pedagogical content knowledge

Initially introduced in the 1980s by Shulman, PCK can be defined as the intersection of mathematics content knowledge with the pedagogical knowledge needed for teaching and learning (Shulman, 1987; Van de Walle, Karp, & Bay-Williams, 2013). According to Gravett and De Beer (2015), PCK also refers to the knowledge teachers have of available and appropriate strategies necessary to make content meaningful and accessible for learners. Pedagogical Content Knowledge enables teachers to identify and integrate knowledge on elements such as the identification of prior knowledge learners might have and how it can be linked to new knowledge, possibly indicating learner misconceptions (Gravett & De Beer, 2015).

1.2.4 Pedagogies of play

Pedagogies of play (also known as play pedagogy) refers to pedagogical models that support the development of play from the perspective of learners (Fleer & Veresov, 2018). Play discourses are usually child-initiated, adult-guided, or policy-driven relating to educational play (Wood, 2014). Research has revealed that there are more approaches to PoP, such as: a-trust-in-the-play approach where the teacher is absent from any initiation between the learner and the ongoing play; facilitate-play approach where the teacher organises the play for the learners; and enhance-learning-outcomes play approach where the play goals are focused on disciplined knowledge (Wood, 2014). Pedagogies of play require a playful classroom environment where learners take risks, make mistakes and explore new ideas (Mardell et al., 2016). In this study, the focus is on puppetry as one of the pedagogies of play..

1.2.5 Puppetry

A PoP such as puppetry is an innovative way to engage learners in the teaching-learning process (Dahlstrom, 2014). Puppetry is one of the most ancient forms of entertainment which is believed to have originated 3 000 years B.C. (Brits, De Beer, & Mabotja, 2016). Teachers are hesitant to apply puppetry as a pedagogy (Brits et al., 2016). Puppetry has a pedagogical advantage – teachers who integrate puppetry create the opportunity for alignment between learners’ real-life experiences and the problem of the puppet character (Keogh, Naylor, Maloney, & Simon, 2008). By aligning real-life experiences and the puppet character, teachers and learners are given a voice that provides them with a “safe space” to vent ideas or problems (Soord, 2008). Puppetry creates possibilities for creativeness, collaboration and critical thinking, while enhancing social skills, language development and self-confidence (De Beer, Petersen, & Brits, 2018; Soord, 2008). Unfortunately, there is a gap in research done on puppetry, particularly in the intermediate phase mathematics classroom (Quintero, 2011).

1.2.6 Teacher professional development

According to Avalos (2011), teacher professional development refers to the sharing of ideas and experiences among teachers while participating actively in an intervention so as to become aware of teaching-learning problems and to conceptualise possible solutions. Teacher professional development provide teachers with additional skills in order to improve on instruction and overall teaching-learning outcomes (Sandilos, Goble, Rimm-Kaufman, & Pianta, 2018).

1.2.7 Self-directed learning

According to Knowles (1975, p. 18), SDL can be defined as “a process in which individuals take the initiative, with or without the help of others in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes”. According to Shannon (2008) metacognitive awareness is the “engine that drives self-directed learning.

1.3 AIMS AND OBJECTIVES OF THE RESEARCH

This study was descriptive of nature as the aim was to describe 10 participating intermediate phase mathematics teachers’ perceptions and experiences before, during and after the intervention addressing PoP and metacognitive awareness to enhance their self-directedness

The objectives of this study included the following:

- (i) To describe intermediate phase teachers' perceptions of pedagogies of play (puppetry) before and during the intervention;
- (ii) To describe intermediate phase perceptions of metacognitive awareness before and during the intervention;
- (iii) To describe intermediate phase teachers' preparation in lesson planning and their writing of puppetry scripts for implementation in their classrooms before and during the intervention;
- (iv) To describe intermediate phase teachers' transfer of pedagogies of play (puppetry) to their respective classrooms after the intervention;
- (v) To describe intermediate phase teachers' transfer of metacognitive awareness to their respective classrooms after the intervention.

1.4 RESEARCH QUESTION(S)

The aim of the study afforded the development of the following primary research question:

1.4.1 Primary research question

- 1.4.1.1 What are intermediate phase mathematics teachers' lived experiences of an intervention based on pedagogies of play (puppetry) and metacognitive awareness to enhance Self-Directed Learning?

The objectives of this study afforded the development of the following secondary research questions.

1.4.2 Secondary research questions

- 1.4.2.1 What are intermediate phase mathematics teachers' perceptions of pedagogies of play (puppetry) before and during the intervention?
- 1.4.2.2 What are intermediate phase mathematics teachers' perceptions of metacognitive awareness before and during the intervention?
- 1.4.2.3 How do intermediate phase mathematics teachers prepare lesson plans and puppetry scripts to implement in their classrooms before and during the intervention?
- 1.4.2.4 What are intermediate phase mathematics teachers' lived experiences of the transfer of pedagogies of play (puppetry) after the intervention?
- 1.4.2.5 What are intermediate phase mathematics teachers' lived experiences of the transfer of metacognitive awareness after the intervention?

1.5 RESEARCH DESIGN AND METHODOLOGY

The following section discusses the research design and methodology employed in this study.

1.5.1 Investigation into the body of scholarship

I investigated the components of this study (intermediate phase mathematics teachers; metacognitive awareness, PCK; PoP; puppetry; teacher professional development; and SDL) individually and in relation to one another. I consulted databases and search engines like Google, Google Scholar, ScienceDirect; Eric, and EBSCOhost. The specific keywords in the search were: intermediate phase mathematics"; "metacognitive awareness"; "self-directed learning"; "mathematical knowledge for teaching"; "PCK"; "pedagogies of play"; "puppetry"; and "teacher professional development".

1.5.2 Theoretical framework

The theoretical framework employed in this study is social constructivism, as conceptualised by Vygotsky (1978), which stems from constructivism. Social constructivism refers to emphasising social exchanges and cognitive growth in teaching-learning endeavours (Amineh & Asl, 2015). Social constructivism allowed the participants to engage in the intervention to socially collaborate in all of the discussions, planning of lessons (using an adapted lesson study format), writing of puppetry scripts, and infusing their lessons with a PoP (puppetry) with the assistance of peer participants and my study supervisor and me, allowing social exchange among each other. Cognitive growth – referring to participants (as learners) – manifested itself when they presented

their planned lesson infused with a PoP (puppetry) to their respective intermediate phase mathematics classrooms. Social constructivism also allowed me to describe participants' perceptions and experiences of PoP (puppetry) and whether metacognitive awareness assisted them in the successful transfer thereof to intermediate phase mathematics classroom – all elements that pertain to the scaffolding participants received during the intervention, allowing for SDL to emerge concerning participants' teaching-learning praxis.

The theoretical framework allowed me to implement third-generation cultural-historical activity theory (CHAT), as conceptualised by Engeström (2009) – which stems from social constructivism – integrated with the Rogan and Grayson model (2003) which focuses on context. In this study, CHAT and the Rogan and Grayson (2003) model were integrated in an authentic way. CHAT allowed for the analysing of the transfer of participants' knowledge, especially via two activity systems. The knowledge that participants gained during the intervention were implemented in their specific school context. The Rogan and Grayson model indicates that the process of change (like the transfer and integration of PoP [puppetry] in the intermediate phase mathematics classroom) is different in every school because it is context-bound. Although this model was based on the implementation of Curriculum 2005 across schools in South Africa, I combined it with CHAT to highlight the differences in approaches teachers in various contexts have when engaged in teaching-learning. The different approaches link to participants' PCK, which was invested in by employing PoP (puppetry).

1.5.3 Empirical study

The empirical nature of this study is subsequently discussed.

1.5.3.1 Research design

The research design for this study aimed to describe the “what” question, inviting theory and theoretical description, a coinciding force behind the data that were collected (Fraenkel, Wallen, & Hyun, 2012).

This study was a generic qualitative study with elements of phenomenology. In qualitative research, individuals attach meaning to their own world and how they experience it (Creswell, 2014). I decided on this research design because I wanted to capture the perceptions and lived experiences of participants in using PoP (puppetry) in their intermediate phase mathematics classrooms.

Phenomenology is based on the work of the philosopher Edmund Husserl (Centre for Innovation in Research and Teaching [CIRT], 2014; Groenewald, 2004). It is a tool for describing human experiences – how humans experience a phenomenon, allowing the researcher to delve into their perceptions, perspectives, understandings and feelings (CIRT, 2014). Phenomenology is more open-ended by nature in order to allow the participant(s) to share more details about their overall experience (CIRT, 2014).

According to Creswell (2014), research designs require a philosophical orientation. I decided on an interpretivistic paradigm, allowing me to work closely together with participants, gaining insight into the descriptions of their perceptions and lived experiences with a PoP (puppetry) in their respective intermediate phase mathematics classrooms. The descriptions allowed me to gain insight into their metacognitive awareness before, during and after the intervention, lesson planning (adapted lesson study), puppetry script writing, presentation of the lesson infused with a PoP (puppetry) and their overall reflection on the meaning they attached to their experience.

1.5.3.2 Site selection

Based on participants’ choice, the research was conducted at their schools (pre-interviews) and the intervention at a venue at the North-West University (NWU). This site made logistical arrangements easier for participants and ensured good attendance at both workshops of the intervention, held on two consecutive Saturdays.

1.5.3.3 Participant selection

The population for this study consisted of three primary schools in the Tlokwe area, which falls under the broader Dr Kenneth Kaunda district. I established via the North West Department of Education and Sport Development's (NWDESD) (2018) website that the North West Department of Education (Dr Kenneth Kaunda District), had a minimum of two teachers per school teaching intermediate phase mathematics at primary schools in Tlokwe. The three schools I chose were located in a rural, township and an urban area respectively. The urban schools I approached did not want to participate in the research, allowing for one township school and two rural schools to serve as sites for participant selection. These three schools necessitated the application of convenient and purposeful sampling, making data collection easily accessible due to logistical reasons. Ten voluntarily participants (N=10) participated in this study. Due to the complex nature of township and rural schools, seven participants were intermediate phase teachers, while three others served as "backup" teachers assisting in the intermediate phase when necessary, but were, at the time of the study, teaching in the foundation phase (see Table 3.6).

1.5.3.4 Data collection instruments and methods

In this study, data were collected before, during and after the intervention using the following methods:

- (i) Semi-structured open-ended individual interviews (prior to workshop one) – see Annexure I. Semi-structured open-ended individual interviews were conducted with each of the participants before the intervention. Workshop one served as an introduction and orientation workshop where participants learned more about different pedagogies such as drama, music, games (puppetry in particular) and metacognitive awareness. The interview questions were developed from the research questions and the body of scholarship.
- (ii) Reflective prompts (during both workshops) – see Annexure F (in the intervention booklet). Participants completed reflective prompts (serving as overall reflection) on the presentations about PoP (puppetry) and metacognitive awareness. These reflective prompts allowed me to capture their perceptions of PoP and metacognitive awareness as well as experiences thereof during the intervention.
- (iii) Observations (during both workshops) – see Annexure J. Observations (by means of field notes) were made during both workshops, but a video-recording was made of participants during their engagement in the adapted lesson study session only, where they planned a lesson infusing mathematics content with puppetry (writing a puppetry script) which they had to teach during the following two to three weeks in their respective intermediate phase

mathematics classrooms. My study supervisor and I assisted participants in the writing of puppetry scripts for their lessons and the mathematising thereof. The video-recording during this particular session allowed me to capture metacognitive behaviour of participants.

- (iv) A post-focus group interview (after workshop two) – see Annexure L. A post-focus group interview was conducted with participants to share their experiences with a PoP (puppetry) and metacognitive awareness during the intervention and how they felt about these topics afterwards. Participants were kindly requested to teach the planned lesson (infused with puppetry) in their own classrooms when the topic was due to teach during the following two to three weeks.
- (v) Reflective journals (after workshop two) – see Annexure M. Participants completed reflective journals after their experiences in teaching-learning with a PoP (puppetry). The reflection on their teaching-learning experience allowed for metacognitive awareness to emerge.

1.5.3.5 Data analysis

Due to the generic qualitative-phenomenological nature of this study, as underpinned by an interpretivist paradigm, pure hermeneutical data analysis as proposed by Nieuwenhuis (2016) for the analysis of the reflective journals, and narrative analysis as proposed by Creswell (2014) for the analysis of the interviews (before and after), reflective prompts and observations were employed.

According to Nieuwenhuis (2016), pure hermeneutics provides a philosophical grounding for interpretivism and entails the sense making of textual data (reflective journals). Applying hermeneutics to analyse reflective journals is based on the understanding of the text as a whole, implying that descriptions thereof guide the anticipated explanations and experiences (Nieuwenhuis, 2016). Hermeneutics allows the unfolding of meanings – deciphering the hidden meaning to unveil the apparent meaning (participant experiences in teaching with a PoP) – allowing rich data to emerge (based on their metacognitive awareness) (Creswell, 2014; Nieuwenhuis, 2016).

Narrative analysis encompasses the study of the lived experiences (prior to, during and after the intervention) by participants in written form (told through their own stories) (Creswell, 2014). Narrative analysis enabled coherence and overall strengthening of the voice of participants regarding their perceptions of their lived experiences with a PoP (puppetry) (Creswell, 2014).

1.5.3.6 Trustworthiness and validity

Trustworthiness and validity can be defined as being “descriptive” (an accurate and factual account of data was collected); “interpretive” (the participants’ data was accurately interpreted); “theoretical” (the concepts and their relationships are correctly defined as to strengthen the meaning behind the collected data) and “evaluative” (rigorous delving into every piece of data that was collected to ensure trustworthiness and validity on account of participants) (Maxwell, 2016). I ensured trustworthiness and validity by following four of the eight strategies applicable to this study, as proposed by McMillan and Schumacher (2014):

- constant comparative method where I employed various data collection strategies to answer my research questions;
- triangulation where I integrated multiple literature sources to confirm my findings;
- respondent language (verbatim accounts) where I asked participants to clarify data obtained from them;
- record data making use of video cameras and my cell phone as a recording device

These strategies and their application in this study are thoroughly discussed in Chapter 3 (see § 3.8.2).

1.5.3.7 Transferability

Transferability refers to how findings of research studies can be applied in other contexts (Babbie, 2016). Due to the elements of phenomenology in this study, the descriptive nature of the data and findings enabled me to describe this study in detail, allowing for this study to be repeated.

1.5.3.8 Researcher’s role

I fulfilled various roles throughout the course of this research: I was an interviewer during the semi-structured open-ended individual interviews and post-focus group interview; I developed an intervention for intermediate phase mathematics participants’ professional development, allowing for reflective prompts as guided feedback, which influenced the limitations and recommendations of this study; I was a facilitator, assisting and supporting participants throughout this intervention and afterwards during their personal teaching-learning endeavours; and observer who noted how participants collaborated to be successful in the overall intervention.

1.5.3.9 Ethical aspects

The study was cleared by the Scientific Committee of the Research Focus Area Self-Directed Learning at the North-West University (Potchefstroom Campus). I then applied for ethical clearance (ethics number: NWU-00788-18-A2) – see Annexure B.

I then proceeded to obtain permission from the North West Department of Education (Dr. Kenneth Kaunda District) five weeks prior to data collection (see Annexure C). The principals at each of the schools also gave informed consent (see Annexure D) together with participants after approval was obtained from the North West Department of Education. Participation in this study was voluntarily. Participants were ensured that they may also withdraw from the study at any moment and that neither the findings nor their withdrawal would be held against them, their principal, their school, or any other party involved. The participants who decided to participate had to complete a letter of informed consent stating that their participation was voluntary (see Annexure E).

In this study, the three schools, the participants, principals, SGB or involved parties were not compared to one another or their names made public, ensuring confidentiality. I also supplied the results of this study to all the parties involved and will provide each involved with an electronic copy of this dissertation after it has been archived in the North-West University's repository.

1.6 CONTRIBUTIONS OF THE STUDY

1.6.1 Contribution to epistemological knowledge

This study contributes to the growing body of knowledge on metacognitive awareness and PoP (puppetry). The intervention also refined design principles for future interventions.

1.6.2 Contribution to methodological knowledge

The study adds to the scholarly research and literature in the field of mathematics teachers' engagement with a PoP (puppetry) and their reflection thereon. The integration of third-generation CHAT in combination with the Rogan and Grayson model served as authentic research lenses, contributing to literature on activity theory.

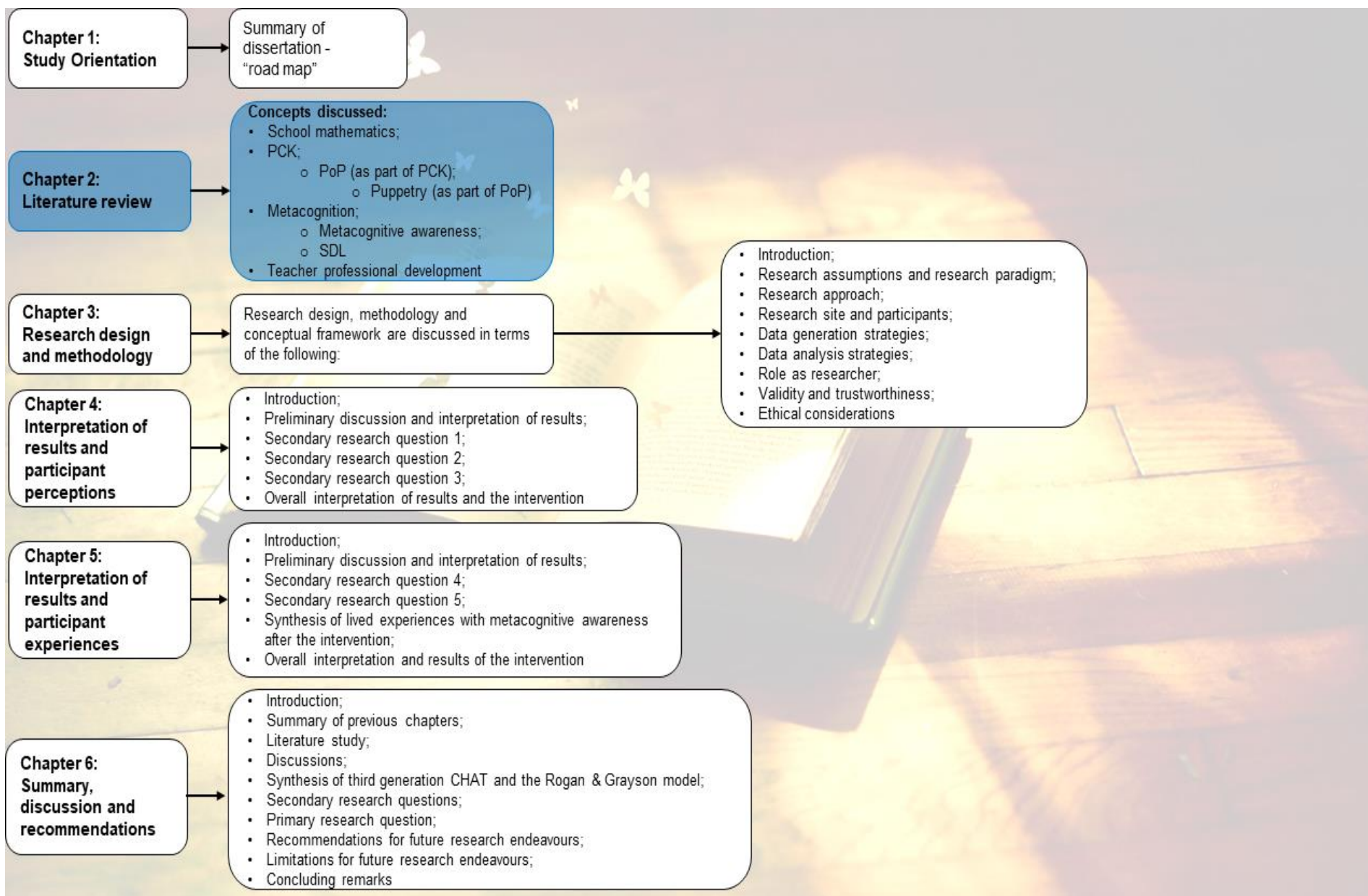
1.6.3 Practical contribution

This proposed study explored the affordances of PoP (puppetry) in intermediate phase mathematics classrooms, and through participation in the intervention, teachers were empowered.

1.7 Chapter summary

Chapter 1 outlines this study and features as a “road map”. Chapter 2 is an in-depth literature study, delving into the body of scholarly work on school mathematics, PCK, PoP, puppetry, metacognitive awareness, its link to SDL and professional development of teachers. Chapter 3 outlines the research design in greater detail. Chapter 4 and 5 discusses the results that emerged from the study to answer the secondary research questions. In Chapter 6, the secondary research questions are summarised and the primary research question is answered, the implications of third-generation CHAT and the Rogan and Grayson model are discussed and synthesised, limitations of this study is discussed and conclusions and recommendations are made for future research endeavours in this field of study.

“In a very real sense, people who have read good literature have lived more than people who cannot or will not read. It is not true that we have only one life to live - if we can read, we can live as many more lives and as many kinds of lives as we wish” (S.I. Hayakawa)



CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In this chapter, literature was consulted on school mathematics, PCK, PoP (as part of PCK), puppetry as part of PoP, metacognitive awareness, SDL, and teacher professional development. Each of these concepts are discussed as they relate to this study and it is also indicated how they are applicable to the educational context.

2.2 The nature of school mathematics

Significant changes occurred in the field of mathematics education pertaining to curriculum reform. These changes were subjected to social needs posed in everyday lived experiences (such as commerce, science and technology) and intellectual needs (such as mathematics as proof structure), to name but a few (Baron, 2016). These needs were met by educating the “future” (the children) who became adults (tomorrow’s workforce), hence a need for improved school mathematics instruction resulted. According to Mulcrone (1958) and Olanoff, Lo, and Tobias (2014), the instruction of school mathematics should be linked to learners’ physical reality as it is much easier recalled by learners in a classroom situation.

School mathematics is constituted in the school classroom (Wong & Sutherland, 2018). It is a concise activity involving particular knowledge but can take on various forms (Gellert & Straehler-Pohl, 2012). According to Gellert and Straehler-Pohl (2012), these forms can be rigorous, principled and specialised practice, arbitrary, vaguely defined and common (best) practice. School mathematics is dynamic by nature due to these various forms attributed to it. These forms are recontextualised and instilled into everyday knowledge and result in best practice in mathematics (Koustourakis & Zacharos, 2011; Straehler-Pohl & Gellert, 2013).

The Curriculum Assessment Policy Statement (CAPS) concerning education in South Africa views school mathematics as:

Mathematics is a language that makes use of symbols and notations to describe numerical, geometric and graphical relationships. It is a human activity that involves observing, representing and investigating patterns and quantitative relationships in physical and social phenomena and between mathematical objects themselves. It helps to develop mental processes that enhance logical and critical thinking, accuracy and problem-solving that will contribute in decision-making (DoE, 2011, p. 8).

CAPS also places emphasis on specific skills learners should attain in school mathematics. Essential mathematical skills are developed when learners (i) utilise and apply the correct mathematical language (vocabulary); (ii) apply correct calculation skills involved with various number concepts; (iii) apply listening and communication skills to assist in logical thinking and reasoning; (iv) investigate ways in which data are analysed, interpreted and represented; (v) ask questions, posing problems and being creative in solving them; (vi) are aware of the importance of mathematics in real-life situations (contributing to the learners' personal development) (DoE, 2011).

These specific skills and the various forms, as suggested by Gellert and Straehler-Pohl (2012), take form while relating to learners' everyday lives, linking real-life experiences. With regards to the CAPS document, the next section aims to provide insight into how school mathematics and mathematics teachers features in the South African intermediate phase classroom.

2.2.1 The South African school context

The education system in South Africa consists of two types of schools, namely public and independent schools. The poverty index of each public school differs and can be related to the environment in which the school is located, namely rural, township and urban schools (Reddy *et al.*, 2013). Rural, township and urban schools each face their own difficulties due to the different contexts in which they are immersed. These difficulties must be met by adequate PCK by teachers in order to address and possibly overcome shortcomings.

Rural schools, scattered and remote, require even more specific pedagogical approaches offering real-life inclusive teaching and learning opportunities for its learners (Organisation for Economic Co-operation and Development [OECD], 2012). The reality (contexts) in rural schools makes it difficult to compete with peers in schools located in nearby towns. Eighty percent of learners in rural areas drop out of school before completing Grade 12 (Bongani, 2014).

Township schools face challenges at a different level than rural schools. There is a large gap in the learner-teacher ratio (Maharajh, Nkosi, & Mkhize, 2016). Overcrowding of classes often lead to multigrade teaching with poor learner engagement and participation in classroom activities. Multigrade teaching needs a different pedagogical approach, where learners are engaged and optimal learning is fostered (Msimanga, 2019).

In urban schools, learners experience less teacher absenteeism, speak English more frequently and have more access to technology (Spaull, 2013). Technology-enabled access to learning resources provides information to learners on multiple answers on topics taught by

teachers (McKnight *et al.*, 2016). Pedagogical approaches where technology is integrated, assist teachers (like with the integration of a PoP [puppetry]), to gain competency in teaching-learning mathematics to learners, equipping them for modern, knowledge-intensive futures (Jojo, 2019; Brijlall, 2014)

2.2.2 School mathematics in the intermediate phase classroom

According to Dowling (2007) and Koustourakis and Zacharos (2011), it is important to note that, in any given curriculum document, the content of school mathematics is supposed to be analysed and categorised into the following four domains listed in the table below:

Table 2.1: Domains of school mathematics

Domain	Description
Esoteric domain	Technical domain – mathematical symbols apply here
Public domain	Context and real-life experiences
Descriptive domain	Modelling of mathematics
Expressive domain	Refers to the combination (specialised content) with the (non-specialised expression)

(adapted from Dowling, 2007; Koustourakis & Zacharos, 2011)

The esoteric domain refers to mathematical knowledge in the form of content knowledge and the language code utilised to express it. In the esoteric domain, the teacher should be able to know and express the various properties involved in the multiplication of whole numbers and express it accurately. The public domain refers to the real-life experiences learners “bring” to the classroom. The teacher should be aware of the learners’ context and utilise it to mathematise the lessons, allowing learners to expand their own referencing frameworks. The descriptive domain refers to how mathematical knowledge can be modelled by applying the knowledge of the esoteric domain. Here, the teacher can model place value by integrating mats, strips and units to assist learners in exploring the base-10 numeration system by modelling addition and subtraction problems. The expressive domain works in combination with the public domain where real-life experiences of learners are integrated in order to reach an understanding of intricate mathematics content. The teacher can integrate indigenous games learners are familiar with (like Morabaraba) and mathematise them so that the learners would be able to draw commonalities between the game board and the characteristics of 2-dimensional shapes.

These domains shape school mathematics. They align learners' real-life experiences with how they relate to mathematics and how difficult they perceive it (Dowling, 2008). Therefore, school mathematics should place emphasis on familiar approaches, providing learners with the opportunity to solve abstract mathematics through familiar ways (Koustourakis & Zacharos, 2011). According to Van de Walle et al. (2010), school mathematics comprises more than just the formulation of tasks and the clarification of concepts in the classroom. School mathematics should foster various skills – such as problem-solving, curiosity, creativity, interdependence and social skills – in order to make learners competitive in the national and international circuit. The next section provides insight into the performance of South African schools, nationally and internationally.

2.2.3 School mathematics performance in national context

The Constitution of the Republic of South Africa states that quality education is a fundamental human right (Arends, Winnaar, & Mosimege, 2017). Although significant progress has been made towards the enrolment of more learners to receive education, the quality thereof may be questioned. These questions arise from the results obtained in the Annual National Assessment (ANA) tests (DBE, 2014).

2.2.3.1 Annual National Assessment (ANA)

The ANA tests are standardised national assessments carried out in language subjects and mathematics in the foundation phase (Grades 1 to 3); intermediate phase (Grades 4 to 6); and senior phase (Grades 7 to 9). The Department of Basic Education (DBE) – formerly known as the Department of Education (DoE) – administered these tests to improve language and mathematical skills of learners (DBE, 2014). They aimed at measuring learners' progress to determine the level at which learners were performing.

Learners were tested on numeracy skills that they obtained during the first three terms of the school year (DBE, 2014). In 2014, the DBE compiled a report on the last ANA results and findings. Table 2.2 shows the national average increase (%) in school mathematics in the intermediate phase over the past three years (2012 to 2014) as obtained from the ANA results.

Table 2.2: National average increase (%) in the intermediate phase (2012–2014)

Grade	2012	2013	2014
4	37%	37%	37%
5	30%	33%	37%
6	27%	39%	34%

(adapted from the DBE, 2014)

According to Table 2.2, Grade 4 learners obtained 37% as national average when tested in 2012. The results of the Grade 4 learners remained the same after two consecutive years of testing (2013 and 2014). Grade 5 learners obtained 30% when initially tested in 2012, but a gradual growth in their national average of the ANA test occurred in 2013 and 2014 when a 3% and 4% growth rate were recorded. Grade 6 learners showed the most growth throughout the ANA tests as they obtained 27% in 2012 as national average, resulting in 12% increase in growth in 2013 and another 4% growth in 2014 in their overall results for the Grade. Since the results in Table 2.2 can be interpreted over a longitudinal period, it seems that learners in Grade 4 in 2012 obtained 30% as national average, but that growth occurred when they advanced to Grade 5 in 2013 where they obtained 33% at national level. Once again, in 2014, the same group of learners (advanced to Grade 6) obtained 43%, which was a significant increase, showing growth in their mathematical knowledge since they were tested in their Grade 4 year in 2012. Although this growth was recorded, the overall findings in the ANA test results concluded that the performance of learners in mathematics in the intermediate phase is a cause for concern (DBE, 2014). The initial target of a 60% increase in mathematics performance was met in the foundation phase, but learners in the intermediate phase were still below target in 2014 (DBE, 2014). Unfortunately, intermediate phase mathematics learners of South Africa are performing below average at international level too (Arends, Winnaar, & Mosimege, 2017).

2.2.4 School mathematics performance in international context

The most renowned study measuring international school mathematics performance is the Trends in International Mathematics and Science Study (TIMSS). TIMSS was introduced in South Africa in 1995 and was continually conducted in 1999, 2003 and 2011 (Reddy et al., 2013). Due to the key nature of mathematics and science, to develop knowledgeable individuals for society, this study was deemed to be appropriate for implementation in South Africa (Reddy et al., 2013).

2.2.4.1 Trends in International Mathematics and Science Study (TIMSS)

TIMSS is a cross-sectional assessment of mathematics and science learners' knowledge in Grade 4 (intermediate phase) and Grade 8 (senior phase). In school mathematics, TIMSS 2011 assessed the following content areas: (i) numbers (30%); (ii) algebra (30%); (iii) geometry (20%); and (iv) data and chance (20%). These content areas were assessed on the following cognitive levels of knowing: (a) knowing (35%); (b) applying (40%); and (c) reasoning (25%) (Reddy *et al.*, 2013).

2.2.4.2 South African learners' performance in the TIMSS study

Although the TIMSS findings concluded that South Africa's mathematics achievement is still low, it improved from 2003 to 2011. However, South Africa's performance in TIMSS 2011 resulted in the country being 41st of 42 participating countries. The TIMSS study was conducted in 2015 and 2019. In 2015, Grade 5 and Grade 9 learners were the only two Grade groups that participated, and findings on Grade 5 learners' performance revealed that three in five South African learners do not even meet the minimum competencies for basic mathematical knowledge required in Grade 5 (Isdale, Reddy, Juan, & Arends, 2017).

In comparison with the TIMSS assessment framework and CAPS, 94% of the mathematics content in the TIMSS tests was covered by the South African curriculum (Reddy *et al.*, 2013). These results (although 94% aligned with CAPS) question the delivery of school mathematics to the South African learner audience (DoE, 2011), which might implicate that South African mathematics teachers lack fundamental understandings of mathematics (Venkat & Spaull, 2015).

2.2.4.3 South African teachers' performance in the TIMSS study

Teachers had to complete a questionnaire as part of the TIMSS 2011 assessment. The results on these questionnaires concluded that 85% of teachers reported that they were "well-prepared" (with adequate MKT and PCK) to teach mathematics or science. Regarding these teachers' qualifications, 60% of them indicated that they completed their degree at university level. At international level, 87% of mathematics teachers completed their degrees (Reddy *et al.*, 2013). Hence, if 85% of teachers concluded that they were "well-prepared" to teach mathematics or science, but only 60% of them completed their degrees, it might be possible that these teachers lacked the metacognitive awareness to critically reflect on their own classroom practice, becoming aware of their inadequate MKT.

According to Brijlall (2014), effective teaching-learning relies on the teachers' understanding of mathematics and what learners know (Brijlall, 2014). When teachers are aware of the gaps in their teaching-learning practice, they can improve pro-actively thereupon – which can be referred to as “best practice”. Best practice is the integration and continuous development of teachers' MKT (especially their PCK), which is discussed in the next section.

2.3 PEDAGOGICAL CONTENT KNOWLEDGE

2.3.1 Theoretical foundations and development

It should be noted that, for the purpose of this study, the focus was on PCK in broad and not on MKT; but because MKT is integral to best practice in the teaching-learning of mathematics, it is discussed later in this chapter. It should be noted that MKT overarches PCK and SMK and is illustrated as follows:

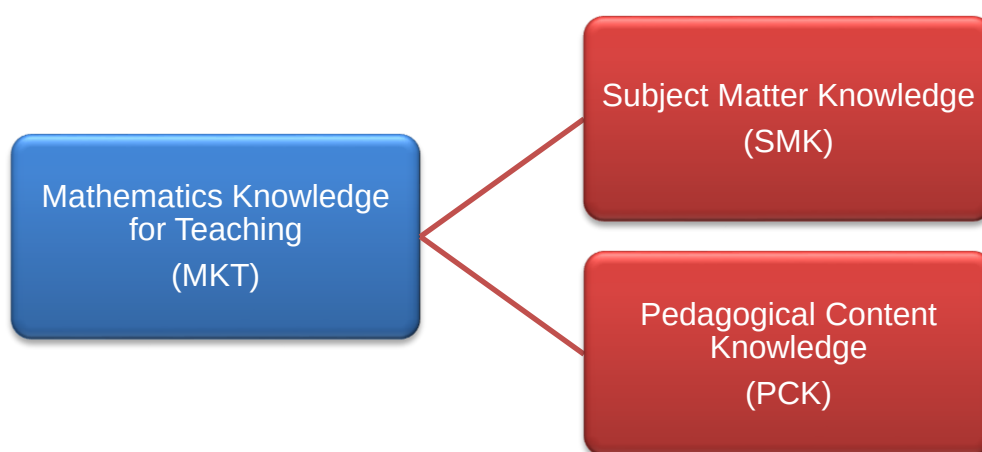


Figure 2.1: Interrelatedness of MKT, SMK and PCK

(adapted from Ball, Thames, & Phelps, 2008, p. 403)

Pedagogical content knowledge (PCK) is specific knowledge of the nature of a subject and best practice with suitable materials to promote and enhance learners' learning (Shulman, 1986; Wood, 2014).

Pedagogical content knowledge was conceptualised and coined by Lee Shulman (Shulman, 1986). The importance of knowledge for teaching was highlighted in the mid-1980s by Shulman, indicating that the conceptualisation of PCK is based on (i) content knowledge, (ii) is topic-specific, and (iii) includes knowledge and representations of learning difficulties and strategies to overcome them (Hashweh, 2013). In 1987, Shulman identified more categories: (iv) general pedagogical knowledge; (v) curriculum knowledge; (vi) knowledge of learners and their characteristics; (vii) knowledge of educational contexts; (viii) knowledge of educational

ends, purposes and values (Hashweh, 2013, p. 116). Shulman continued to emphasise that PCK is topic-specific and develops because of interactions among these different elements. Pedagogical content knowledge with its numerous elements is complex. Therefore, Ball et al. (2008) developed a subject-specific model for school mathematics based on the work of Lee Shulman's PCK (Nolan, Dempsey, Lovatt, & Shea, 2015). The model is referred to as Mathematical Knowledge for Teaching (MKT) and is identified as one of the overarching frameworks for teaching-learning and overarches PCK (Hill, 2010).

2.3.2 Pedagogical content knowledge in context

In rural, township and urban schools, teachers' PCK differs due to different contexts and shortcomings. According to the Centre for Development and Enterprise – CDE, (2011), teachers' lack of PCK is one of the main reasons for underperformance in science-driven (including mathematics) school subjects (Bernstein, 2011). These findings may link to under-prepared teachers with poor metacognitive awareness. Literature suggests that further research could explore different pedagogies utilised by teachers in order to facilitate mathematics content, as well as how teachers can engage in a teaching-learning praxis whilst being more metacognitively aware of what and how they teach (CDE, 2011; Du Toit & Kotze, 2009; Rollnick Mavhunga, 2015).

Many advances have been made in the literature on PCK. Different models have been developed for different needs and subjects. For instance, Koehler and Mishra (2009) developed a PCK model where the technology is integrated (Technology Pedagogical Content Knowledge – TPACK), stressing the importance of best practice with the integration of technology. Davidowitz and Rollnick (2011) developed another PCK model where context is included but based on teachers' beliefs of the teaching of science (mathematics). In this research, the focus was on what teachers "do" with their content knowledge (personal PCK – influenced by their beliefs), exploring the tensions between measuring and portraying PCK and relating it to learner achievement (Rollnick & Mavhunga, 2015).

It is important to note that, in this research, the focus was on PCK and how the PCK model developed by Ball et al. (2008) is integrated in MKT.

2.3.3 Mathematical knowledge for teaching and pedagogical content knowledge

For any mathematics teacher to be successful in his or her teaching-learning praxis, various aspects of knowledge are needed. Therefore, MKT is critical for mathematics teachers to successfully bridge mathematics content, making it understandable and its learning

meaningful for the learners sitting in front of them, irrespective of their background (Hill, 2010; Hill, Rowan, & Ball, 2005), hence broadening their PCK.

According to Ball et al. (2008), MKT can be illustrated as follows:

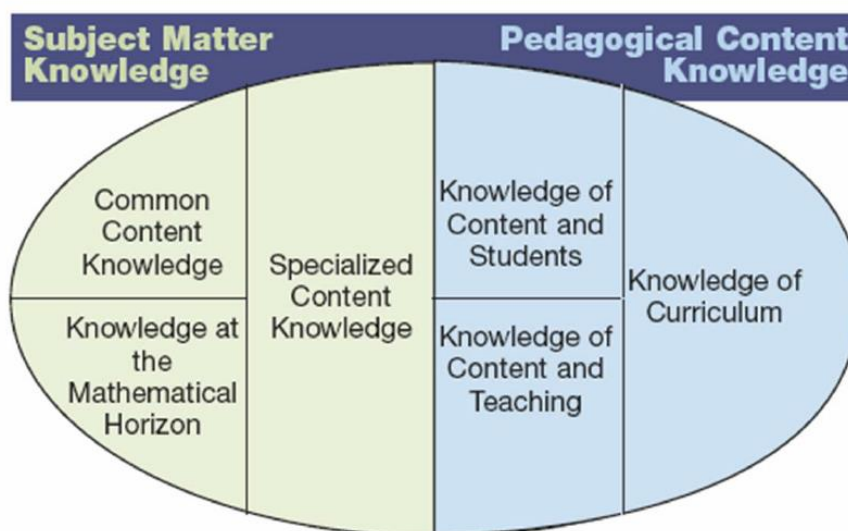


Figure 2.2: Mathematical knowledge for teaching

(source: Ball et al., 2008, p. 403)

Hill and Ball (2009) claim that knowledge for teaching mathematics does not require of teachers to only compute correctly and properly; they should also know how to integrate mathematical language correctly (explaining mathematical processes and concepts), utilise pictures/figures, models or any relevant materials to support learners' learning, offering clarification of mathematical procedures and rules while aligning learners' real-life experiences with that of "abstract" school mathematics (Olanoff et al., 2014).

The researchers (Ball et al., 2008) claim that MKT requires a combination of various knowledgebases (nested in two key domains, namely subject matter knowledge (SMK) and PCK, namely:

(i) Common content knowledge; (ii) Knowledge at the mathematical horizon; (iii) Specialised content knowledge; (iv) Knowledge of content and students; (v) Knowledge of content and teaching; (vi) Knowledge of curriculum (supported by Nolan et al., 2015). In the next section, these domains and bases are discussed.

2.3.3.1 Subject matter knowledge

The subject matter domain comprises of the following knowledgebases (Ball et al., 2008; as supported by Nolan et al., 2015):

- Common content knowledge

Common content knowledge refers to the mathematics teacher being able to utilise skills and mathematical knowledge to complete the school mathematics that the learners are supposed to be doing – such as the algorithm enabling one to multiply two numbers (Ball et al., 2008; Nolan et al., 2015).

- Knowledge at the mathematical horizon

Knowledge at the mathematical horizon refers to the knowledge the mathematics teacher has of the total span of mathematics in and beyond the curriculum (in a certain phase), therefore enabling him or her to know how different topics are related and can be expanded across Grades – such as multiplication of two numbers relates to the multiplication of two polynomials (Ball et al., 2008; Lee, 2010).

- Specialised content knowledge

Specialised content knowledge refers to unique knowledge and skills mathematics teachers have to look for student errors, using them to predict and diagnose misconceptions that learners may have in the future, as well as using valid nonstandard approaches to bridge the mathematics content for the learner – such as the algorithm of multiplication links to place value and the distributive property (Ball et al., 2008; Nolan et al., 2015).

2.3.3.2 Pedagogical content knowledge

The PCK domain comprises of the following knowledgebases (Ball et al., 2008; Nolan et al., 2015).

- Knowledge of content and teaching

Knowledge of content and teaching refers to the combination between “knowing how to teach” and “knowing mathematics”. Knowing how to teach (teaching-learning strategies) gives purpose to let learners to “get to know” school mathematics – the correct combination between these two is very important (Ball et al., 2008; Nolan et al., 2015).

- Knowledge of content and learners

Knowledge of content and students combines mathematics teachers' knowledge about their learners (such as real-life experiences, context, skills, strengths, weaknesses etc.) with their knowledge of mathematics, enabling them to anticipate learner responses, what they would find interesting, motivating, difficult and to be able to interpret learners' work (Ball et al., 2008; Nolan et al., 2015).

- Knowledge of curriculum

Knowledge of curriculum refers to the knowledge of mathematics teachers regarding the interpretation and implementation of the curriculum document as “pace setter” in order to teach and cover all of the necessary concepts required for learners to advance to the following Grade (phase) and to subsequently build on their knowledge for mathematics (Ball et al., 2008; Kleickmann et al., 2013).

According to Hill et al. (2008), teachers' mathematical knowledge and their teaching of the subject links to increased MKT, leading to “high quality mathematics instruction” (Hill et al., 2008). According to Conley (2017), teachers with increased MKT are able to (i) minimise or rectify mathematical errors and misconceptions; (ii) integrate their knowledge of mathematics to be rigorous in their explanations, providing a well-supported analysis of mathematics to their learners; (iii) provide rich mathematics environments for their learners, leading to deeper discussions; (iv) implement the curriculum in a critical manner while investing time and energy into supplemental resource material synthesis; (v) provide high-quality lessons in mathematics, followed by deep discussions of content between teacher and learner; and lastly, (vi) provide optimised opportunities for learning in the mathematics classroom.

According to Vogt et al. (2018), the characteristics of mathematics teachers with increased MKT can be fostered through PoP. Therefore, the interrelatedness of MKT, PCK, SMK and PoP is illustrated in Figure 2.3 based on its relatedness in this study.

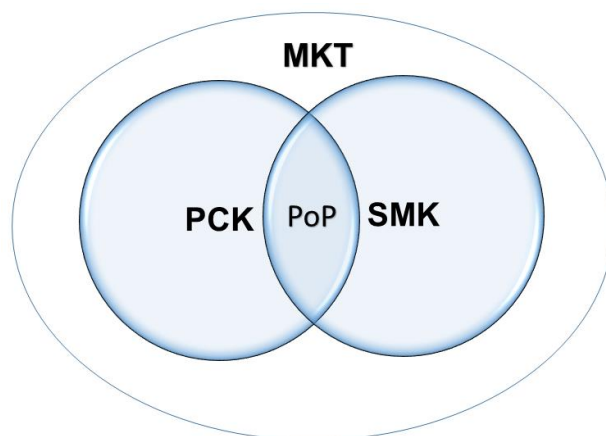


Figure 2.3: Interrelatedness of MKT, PCK and PoP

It should be noted, however, that MKT overarches SMK and PCK and that Pedagogy of Play (PoP) features as a link to enhance teaching-learning in the intermediate phase mathematics classroom. Pedagogy of play (PoP) is discussed in the next subsection,

2.3.4 Pedagogy of play

2.3.4.1 Theoretical foundations and development

Pedagogy of play (with specific focus on its educational value) is characterised by two fundamental elements (which also serve as the basis of education), namely: (i) spontaneous and natural, and (ii) intentional (Farné, 2005; Kanter, Howad, Adams, & Fernandez, 2011). The focus of PoP is usually placed on the intentional element relating to the design and management of play experiences and materials for learners with a teacher who has clear goals in mind (Farné, 2005). However, PoP is more than that: it analyses the playing experience as a whole, attempting to grasp potentialities, material conditions and how meaning is created when implemented in subject-specific contexts (Farné, 2005; Kanter et al., 2011).

PoP was coined by Gunilla Lindqvist (Baumer, 2013; Lindqvist, 1996). Lindqvist based her research on that of Vygotsky, embracing his cultural approach to learners' play, stressing the need for play-based pedagogy in classrooms (Baumer 2013). According to Vygotsky (1978), PoP teaches learners self-control, allowing them to learn more. Vygotsky considered play as meaningful because it created new learning experiences through which learners could learn new information (Vygotsky, 1967). According to Overholt (2010), learners are able to reach beyond their Zone of Proximal Development (ZPD) – as introduced by Vygotsky – because PoP assists them to experiment with characteristics and behaviours that are present in their real-life experiences, which seldom surface to be experimented with in the classroom.

According to Lindqvist (1996), as the 20th century drew to a close in many Western societies, the “play” element in learners’ lives became “segregated” into designated areas and time slots. Learners no longer learn through play, but play was limited to playgrounds and after school hours (Baumer, 2013). According to Nilsson (2009), teachers (and parents) believed that the segregation of learners’ play should be spontaneous without adult guidance, protected by these dedicated “spaces”. Wood (2014) states that play can be child-initiated, adult-guided, or policy-driven. However, the absence of teachers (and parents) in learners’ play has led to the depletion of cultural resources where commercial toys, objects and material culture replaced teachers (and parents’) presence, placing a damper on creativity and imagination (Baumer, 2013).

The trend during the 21st century can be contrasted as PoP advocates adult (teacher/parents) and child joint play (Baumer, 2013). Teachers provide an array of resources when play is initiated in the classroom such as: (i) social, (ii) emotional, (iii) cognitive, and (iv) communicative resources. As soon as learners engage in play in the classroom, their expertise, imaginations, playfulness and improvisational competence hinge on these resources, creating a unique experience where teaching-learning is optimised (Miyazaki, 2010).

Classroom teaching-learning requires creative strategies and PoP lays an ideal foundation for learning (Vogt et al., 2018). Learning through play can occur by implementing various games, like card and board games, indigenous games (like Morabaraba), puppets, or even computer-based gaming (Bendixen-Noe, 2010; Brits et al., 2016; Nkopodi & Mosimege, 2009; Vogt et al., 2018). According to Remer and Tzuriel (2015), learners engage easily in PoP, without fearing any obstacles (accepting the challenge), while the knowledge is retained and assimilated over a period of time. In this study, the focus was on puppetry as teaching-learning strategy in order to implement PoP in the intermediate phase mathematics classroom. A PoP (like puppetry) refers to the incorporation of art in education, which is a recent shift in 21st-century teaching-learning approaches. This is discussed next.

2.3.4.2 Art in Education

The National Science Foundation (NSF) and other stakeholders introduced a new type of comprehensive science education infused with technology and mathematics at the end of the 20th century (Bequette & Bequette, 2012). The NSF aimed to identify the overlap between science, technology, engineering and mathematics, hence the acronym STEM (Science, Technology, Engineering and Mathematics). As research in this field expanded, other fields

were added to the acronym, such as art, hence the shift from STEM to STEAM education (Piro, 2010).

Due to the representational nature (such as language, graphs, symbols, diagrams, pictures, tables) of school mathematics, various forms of art (such as painting, drawing, drama, puppetry) may be used as creative educational tools that teachers may utilise as an entry point in their lessons to make content meaningful (Fenyvesi, 2012). According to Fenyvesi, 2014:

“All these activities extend the standard teaching programs and develop the creative thinking of the students (learners) by burdening their left and right cerebral hemispheres more or less equally balanced, and by facilitating interaction between the two hemispheres of their brain. The creative artistic practice helps the students (learners) to understand and familiarize the algebraically formulated regularities of mathematics, and contributes to their abilities to make abstract mathematics conscious” (p. 2).

Art in education creates a positive teaching-learning environment where complex relationships are explored and grasped, allowing for joy, social integration and support to surface in learners’ learning achievements (Fenyvesi, Koskimaa, & Lavicsa, 2015). Art-related strategies (like puppetry) can lead to an increase of cultural, interdisciplinary and artistic embeddedness of mathematical knowledge stemming from learners’ real-life experiences (Fenyvesi et al., 2015).

In this study, puppetry was used as a form of art (drama) that teachers could utilise in their intermediate phase mathematics classrooms based on the value thereof as established in the discussion above. Puppetry as a PoP is discussed in the next subsection.

2.3.4.3 Puppetry as a pedagogy of play

South Africa is a multicultural society. Learners across various cultural backgrounds and social settings come together to engage in teaching-learning tasks (Brits et al., 2016). Therefore, finding a unique pedagogy that would appeal to a multicultural classroom is difficult. I argue that puppetry as a PoP is a unique teaching-learning strategy that can be utilised.

2.3.4.4 Drama (puppetry) and storytelling as pedagogy of play

Storytelling is the oral tradition of many indigenous knowledge holders in Africa, including South Africa, where it was utilised to convey knowledge to children to teach them valuable lessons of life and to prepare them for various encounters (Sium & Ritskes, 2013). For the purposes of this research, I will not be delving into indigenous knowledge in detail, but it can

be defined as follows: Indigenous knowledge is local knowledge (context-specific, occurring in a specific place) and is different to other ways (Western ways) of knowing (Khupe, 2014). Indigenous knowledge can be transmitted orally (via storytelling) and is holistic by nature (Cronje, De Beer, & Anckiewicz, 2015).

Storytelling and puppets as PoP can be an appropriate medium to use in classrooms because they involve communication (Brits et al., 2016). According to Dahlstrom (2014), storytelling creates interest, enhances understanding and memory regarding the information pertained in the story and captures interest. Storytelling hinges on emotions, which entail improved comprehension and understanding by individuals (Brits et al., 2016).

Storytelling can be fostered by the incorporation of drama mediums like puppetry. When referring to school mathematics, creativity and imagination is dampened, resulting in uninterested learners (Acharya, 2017). Creativity and imagination have educational potential in school mathematics and puppetry may create these teaching-learning environments (Brits et al., 2016; Mann, 2006).

2.3.5 Puppetry

According to Kröger and Nupponen (2019), puppets are deemed to be useful pedagogical tools and their potential could be integrated more likely in schools. Puppetry has a rich history as an early form of entertainment which was integrated to animate and communicate ideas and needs of various human societies – a rich chapter of culture and tradition (Brits et al., 2016). The word *puppet* stems from the Latin “pupa”, which refers to a small creature (Ahlcrona, 2012). The idea that a puppet “is alive” has always fascinated humankind and inspired their imagination. According to Ahlcrona (2012), a puppet can be defined as a material artefact that incorporates specific movements – the activities in which puppets engage allow for their communicative potential to emerge, allowing for spectators’ (learners’) thoughts, emotions and associations to be hinged on these activities.

Various other forms of puppets exist, such as hand puppets, rod puppets and finger puppets. The form of puppet used depends on the educational context, such as remedial uses; therapeutic uses or teaching-learning in general. Typically, puppets are presented in a puppet theatre by teachers, allowing for more detail to arise, such as attitudes or potential themes like disabilities, to name but a few (Kröger & Nupponen, 2019). Puppetry is a very creative strategy, since writing a puppetry script, performing with the puppet and integrating it into a subject can be seen as a form of artistic education (Kröger & Nupponen, 2019; Remer & Tzuriel, 2015). Puppets can also be integrated to teach special needs learners, since puppets

tend to build upon the concept of self-worth, emotional release and other impairments (Aronoff, 2005; Renfro, 1984). According to Gobec (2012), puppetry is something that can be implemented for a long term as it is appealing to a diverse field of applications and subjects.

Puppetry can be applied as a mediating tool where the teacher as puppeteer expresses a motive with which the learners interact (Ahlcrona, 2012; Gobec, 2012). Another form of mediation emerges where the learner as puppeteer expresses understanding when he or she utilises the puppet to engage in conversation with the teacher or a peer. According to Feuerstein, Feuerstein, Falik, and Rand (2006), mediated learning experiences can be seen as a way in which learners traditionally experience teaching-learning, which is then mediated by an agent (teacher as puppeteer or learner as puppeteer – utilising the puppet) to meet lesson outcomes or goals, hence transferring knowledge in a meaningful, understandable way that is accessible for all.

Figure 2.4 illustrates how puppetry is integrated by teachers (puppeteers), and in some cases, by learners as puppeteers, to mediate the learning process.

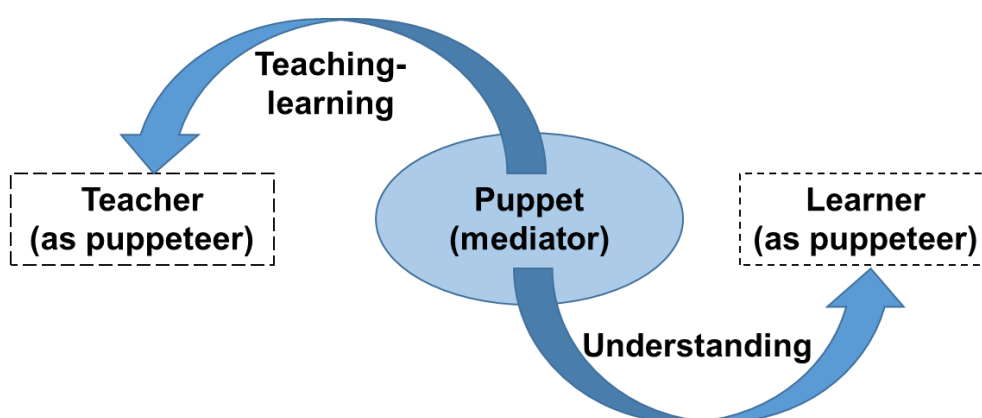


Figure 2.4: Puppetry as mediator

In Figure 2.4, when a puppet is utilised by teachers, relief is experienced by learners: they are relieved of their fear of authority, establishing contact with their classroom environment and what is being taught (Korošec, 2012). Learners often confide in the puppet, they like to touch and stroke it, leading to relaxed conversations of content, which enable teachers to meet curricular goals in a positive classroom environment (Korošec, 2012). When a puppet is utilised by learners, they tend to express themselves because should errors be made, it is made on account of the “puppet as an individual” and not by the learner (Ahlcrona, 2012). The teacher can also identify misconceptions in learners’ understanding when explaining a

specific mathematical topic and posing these questions to the puppet, allowing the learner to take note of these errors and learn from them.

In a recent literature study by Kröger and Nupponen (2019) on puppets as pedagogical tools, they established from more than 10 studies that puppetry has five potentials for a classroom, namely:

- increased generation of communication;
- fostering a positive classroom environment;
- creating a creative space;
- fostering co-operation and group integration;
- influencing learner attitudes.

These five potentials are discussed in the following subsections.

2.3.5.1 Increased generation of communication

According to Kröger and Nupponen (2019), communication between learner and teacher, and vice versa, allows for the transfer of information, which can also be linked to metacognition, since reflection whether the learner understands the content of the lesson or would be able to reach the lesson outcomes can be established. Puppets can be seen as a mediating tool for teachers' and learners' learning, communication and personal interaction (Ahlcróna, 2012; Keogh et al., 2008; Korošec, 2012, 2013).

2.3.5.2 Fostering a positive classroom environment

According to Evans, Harvey, Buckley and Yan (2009), classroom climate has three components: (i) academic; (ii) management, and (iii) emotional. Puppets are helpful tools in advancing all three of these components, which leads to increased motivation among learners (Kröger & Nupponen, 2019).

2.3.5.3 Creating a creative space

According to Brèdikyte (2002), puppetry can be employed to stimulate learners' individual creativity as puppets challenge learners and provide a possibility to express themselves (albeit wrong) (Korošec, 2012, 2013). When learners are in the presence of a puppet, they must

create something for the puppet to help them with the problem they are facing, also allowing for additional and creative approaches (Ahlcrona, 2012).

2.3.5.4 Fostering co-operation and group integration

Puppets can assist learners to integrate and cooperate in group work, since it allows for the release of tension when the learners are in a space to assist the puppet and, by so doing, relieve themselves in their own way (Korošec, 2012). Puppets also increase socialisation and they are considered as group members (Kröger & Nupponen, 2019; Remer & Tzuriel, 2015).

2.3.5.5 Influencing learner attitudes

Both younger and older learners find puppets appealing. It was noted in a study done by Whiteland (2016) that the integration of puppets allows learners to construct new meaning regarding their understanding of a topic. This may lead to an overall positive attitude towards the subject as they have an improved understanding of the content.

Puppetry in education has addressed various social issues; however, a review of existing literature reveals little research on the application of puppetry in the intermediate phase, especially in school mathematics (Keogh & Naylor, 2009). Teachers are also hesitant to use puppetry as a teaching-learning approach, among others (Brits et al., 2016). The literature study conducted by Kröger and Nupponen (2019) revealed six studies in the intermediate phase (elementary school or primary school) that integrated puppetry. The other studies focused on preschool, kindergarten, one junior high school, and one middle school. The following is a brief overview of the six intermediate phase studies as adapted from Kröger & Nupponen, 2019, p. 395:

- i. Dunst (2012): Study indicated that puppetry can enhance knowledge and influence attitudes about learners with disabilities;
- ii. Fisier (2003): Study indicated that puppet theatre, especially, can encourage learners to improve on their reading skills and that learners enjoy it as a medium of teaching-learning;
- iii. Hackling, Smith, and Murcia (2011): Study indicated that puppets stimulate increased communication in the classroom;
- iv. Keogh et al. (2008): Study indicated that puppets positively influence learner engagement and motivation;
- v. Korošec (2012): Study indicated that puppets assist in personal interaction as well as communication;

- vi. Whiteland (2016): Study indicated that puppetry creates understanding and allows learners to attach more meaning to content.

In another study conducted by Gobec (2012), it emerged that puppets can be used over a prolonged period of time; hence puppets' application stems from diverse uses (such as used for different purposes in teaching-learning) and they could be used to connect various subjects (acquiring learners to perceive the link between various subjects and their interrelatedness).

The power of puppets in education is nested in its nature as a three-dimensional symbolic art form; hence their visual appearance, being able to move and speak (Remer & Tzuriel, 2015). These characteristics make it possible for teachers to transfer knowledge through a number of learners' senses, opening the door for multiple intelligences to surface (Remer & Tzuriel, 2015).

The engagement with puppets as mediator gives rise to multiple intelligences because there are so many elements involved when life is given to puppets through the puppeteers (teachers and/or learners) in the mathematics classroom. It should be noted that multiple intelligences are mentioned in this chapter to demonstrate the different intelligences a PoP (puppetry) activates.

2.3.6 Multiple intelligences

According to Gardner's theory (and research done in the field of play by Bredikyte, 2002; Hamre & Oyler, 2004; Gardner, 2008; Korošec 2012; 2013), it can be established that drama (puppetry) develops learners' multiple individual intelligences, talents and skills. Howard Gardner (1993) coined the term "multiple intelligences" and developed this theory during the 1970s and early 1980s (Davis, Seider, & Christodoulou, 2011; Korošec, 2013). The eight multiple intelligences referred to are: (i) linguistic intelligence (spoken and written language); (ii) logical-mathematical intelligence (logical analysis of problems); (iii) musical intelligence (performance, appreciation and composition of musical patterns); (iv) bodily-kinaesthetic intelligence (using whole or partial body to solve problems); (v) spatial intelligence (recognition of patterns in spaces or confined environments); (vi) intrapersonal intelligence (self-understanding of feelings, motivations and fears); (vii) interpersonal intelligence (understanding of desires, motivations and intentions of others); and (ix) naturalistic intelligence (recognition and categorisation of the environment) (Davis et al., 2011; Gardner, 1993; Korošec, 2013).

In school mathematics, PoP (puppetry) can address the multiple intelligence theory as proposed by Gardner (1993) (illustrated in Figure 2.5).

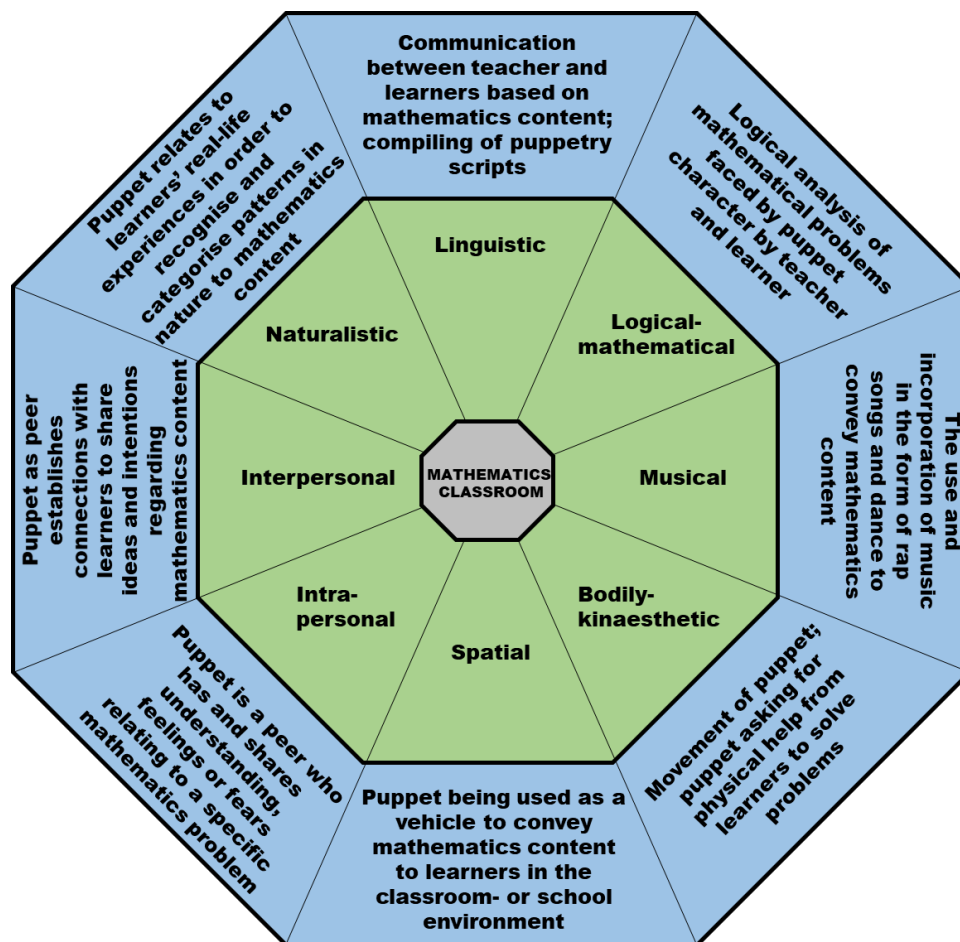


Figure 2.5: Multiple intelligences in the mathematics classroom

(adapted from Booth & O'Brien, 2008)

This study is based on teachers in the intermediate phase mathematics classroom. Therefore, Figure 2.5 should be interpreted as such. Linguistic intelligence in the application of puppetry relates to how the mathematics content is being transferred by the teacher (puppeteer) to the learners. It also refers to how the teacher (puppeteer) designs the puppetry script based on the mathematics content before it is taught (referring to professional development). Logical-mathematical intelligence refers to the problem the puppet character is facing regarding the mathematics content, where the puppet asks learners for assistance in solving it. Musical intelligence can be incorporated by allowing learners to write rap songs about the mathematics content, or to perform a dance to illustrate certain principles, which accounts for a lot of creativity and fun in the mathematics classroom.

Bodily-kinaesthetic intelligence manifests already in the physical form of the puppet, but the teacher (puppeteer) utilises the puppet to ask learners to use their own bodies when measuring objects (such as hands and feet) – also referred to as embodiment of teaching-learning. Spatial intelligence refers to the learners' awareness of the classroom environment

and how (and with what) the puppet enacts in this space to convey the content to learners. Intrapersonal intelligence refers to the puppet having his or her own understanding and feelings about the mathematics content (and may even disclose his or her fears, like making mistakes, to the learners). Interpersonal intelligence refers to the puppet (as a peer), sharing his or her ideas and intentions about the mathematics content with the learners, scaffolding their understanding and learning them to the goals of the intended lesson. Naturalistic intelligence surfaces where the puppet makes references to learners' real-life experiences of nature and how it serves as example as to where mathematics can be found outside of the school environment.

Multiple intelligences and embodied, situated and distributed cognition (ESDC) are interrelated. According to Hardey-Valle and Payette (2008), ESDC learning is viewed as something that cannot occur when isolated, since cognition itself is dependent on neural, cognitive and social actions (De Beer & Petersen, 2016). Since the brain maintains bodily functions (embodied cognition), the physical actions (situated cognition) by individuals (teachers and learners), distributed cognition are seen as an extension of the brain (De Beer & Petersen, 2016; Hardey-Valle & Payette, 2008; Holvikivi, 2007). These physical actions stem from what is happening in the individual's social context (such as using a puppet to explain mathematical reasoning), which is required by the teaching-learning environment (in order for the teacher to reach teaching-learning goals and for learners to be able to understand mathematics in a meaningful manner).

2.3.7 The link between puppetry and multiple intelligences

Research by Keogh et al. (2008) indicated that teachers who integrate puppets, move from a traditional teaching-learning praxis to a more reflective practitioner due to the puppet character who: (i) does not understand the teaching-learning material (linguistic intelligence); (ii) raises issues and questions (spatial intelligence); and (iii) presents misconceptions, challenging the learners to engage in a problem-solving manner (logical intelligence). These issues faced by the puppet needs to be researched and built into the lesson, allowing the teacher to do research, reflect and redesign the lesson in order for it to be more successful and meaningful (Korošec, 2012). The design of the lesson may lead to the incorporation of music (musical intelligence), making the lesson more interesting for learners.

According to Keogh et al. (2008), puppetry creates a doorway for authentic problem-solving that is rooted in learners' real-life experiences (naturalistic intelligence), allowing them to identify with the problem faced by the puppet character. Puppetry has a powerful influence on learners of all ages because its movements convey teaching-learning material is captivating

(bodily-kinaesthetic intelligence) (Brits et al., 2016; Naylor et al., 2007). Puppets let teachers and learners engage with one another (interpersonal intelligence), get to know and learn from one another, grow and be self-confident and expressive by relating openly to what the puppet character is facing (intrapersonal intelligence) because the puppet is viewed as a peer and is therefore depersonalised (Astles, 2012; Remer & Tzuriel, 2015). Naylor et al. (2007) believe that teachers can transform barriers to learning (like oppositional behaviour, negativity and defensive attitudes towards a subject) to a positive teaching-learning environment.

According research done at the Karyn Purvis Institute of Child Development (2016), it takes the brain approximately 400 repetitions to form a new synapse, but when done through play while learners experience enjoyment and feel safe, it takes about 12 repetitions (Wilson, n.d.). Therefore, puppetry is an all-inclusive teaching strategy, allowing for interconnectedness across all the intelligences – as proposed by Gardner’s (1993) multiple intelligence theory – developing learners’ talents and skills and creating an overall positive learning environment in the mathematics classroom.

In this chapter, I have established thus far that MKT overarches PCK and SMK and that PoP (puppetry) is the link between these concepts relating to the field of mathematics as applicable to this study.

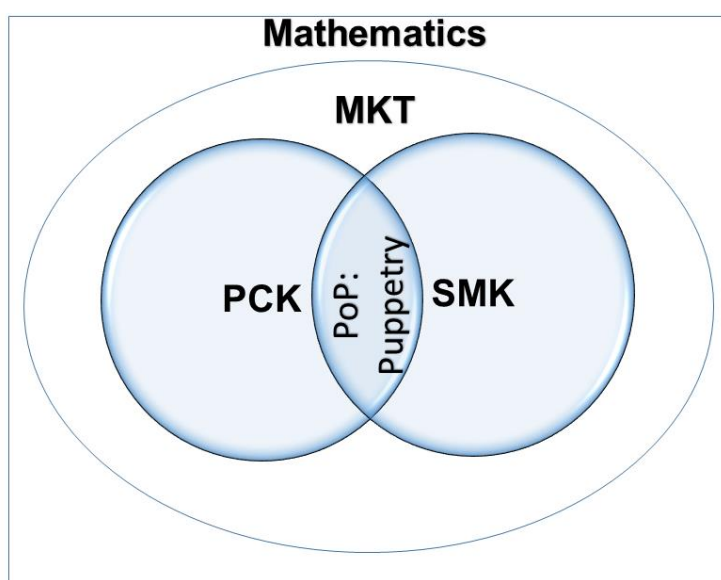


Figure 2.6: Interrelatedness of MKT, PCK, PoP and puppetry

Puppetry is but one strategy of PoP and can be added to the repertoire of intermediate phase mathematics teacher. In order to successfully integrate puppetry as a PoP, reflection on

teaching-learning activities are necessary, which refers to metacognition. This is discussed in the next subsection.

2.4 METACOGNITION

2.4.1 Theoretical foundations of metacognition

Although the theoretical foundations of metacognition can be found in psychology, John Flavell – a pioneer in the field of metacognition research – defined the term *metacognition* as “[k]nowledge about cognitive phenomena” or “thinking about thinking” (Flavell, 1979, p. 906). Many advances have been made in the field of metacognition research. The prefix “meta” means “beyond”, and the word “cognition” means “knowing” (Shetty, 2014). Therefore, metacognition is the process of going beyond knowing for understanding to be reached (Shetty, 2014). Flavell introduced the dimensions of metacognition as metacognitive knowledge; metacognitive experiences; and metacognitive skills (later called self-regulation) (Flavell, 1979). According to Fox and Riconscente (2008), theories by James, Piaget and Vygotsky are interrelated to the dimensions of metacognition. Early psychologists utilised self-analysis when finding answers for psychological questions – this was the first step in what was later defined as part of metacognitive processes (Noushad, 2008). Table 2.3 summarises the influence of well-known theories on metacognition.

Table 2.3: Theories and their interrelatedness to metacognition

Pioneer	Theory focussed on	Interrelatedness to metacognition
Jean Piaget (1959)	Human development and learning	Directed thought is conscious – entails the ability to think about your own thoughts
John Flavell (1979)	Developmental psychology	Coined the term for metacognition
Lev Vygotsky (1986)	Social interaction	Consciousness relates to the awareness of mind activity. Metacognitive awareness is established
William James (1992)	Introspection	Introspection was based on self-regulation principles and reflection

(adapted from Flavell, 1979; James, 1992; Piaget, 1959; Vygotsky, 1986)

Piaget’s (1959) theory focused on child development relating to children’s cognitive stages (Table 2.3). Flavell became interested in these cognitive stages and continued his research to extend Piaget’s theory by directing his efforts towards how learners think about their own thinking processes (Flavell, 1979). Vygotsky found that social interaction plays a vital role in cognitive activity, leading to the sociocultural approach in cognitive development (Vygotsky,

1986). William James' theory (relating to social interaction in Lev Vygotsky's work) led to the development and contribution of introspection, where awareness (consciousness) would lay the foundation for the self-regulation principles in metacognition.

Researchers still quote Flavell (1979) today due to his influential contribution to the body of scholarship of metacognition. The establishment of the initial dimensions by Flavell (1979) were further refined by Brown (1980) and Paris, Cross, and Lipson (1984) as declarative-, procedural- and conditional knowledge. The body of scholarship of metacognition suggests that metacognitive skills (self-regulation) are context- or concept bound (Veenman, 2011), and that the primary dimensions are facilitated through reflection (Cornoldi, 1998). Therefore, metacognitive skills can vary depending on the nature of the study (such as focusing on the teacher or the learners). Figure 2.7 illustrates the theoretical foundations and development of metacognition.

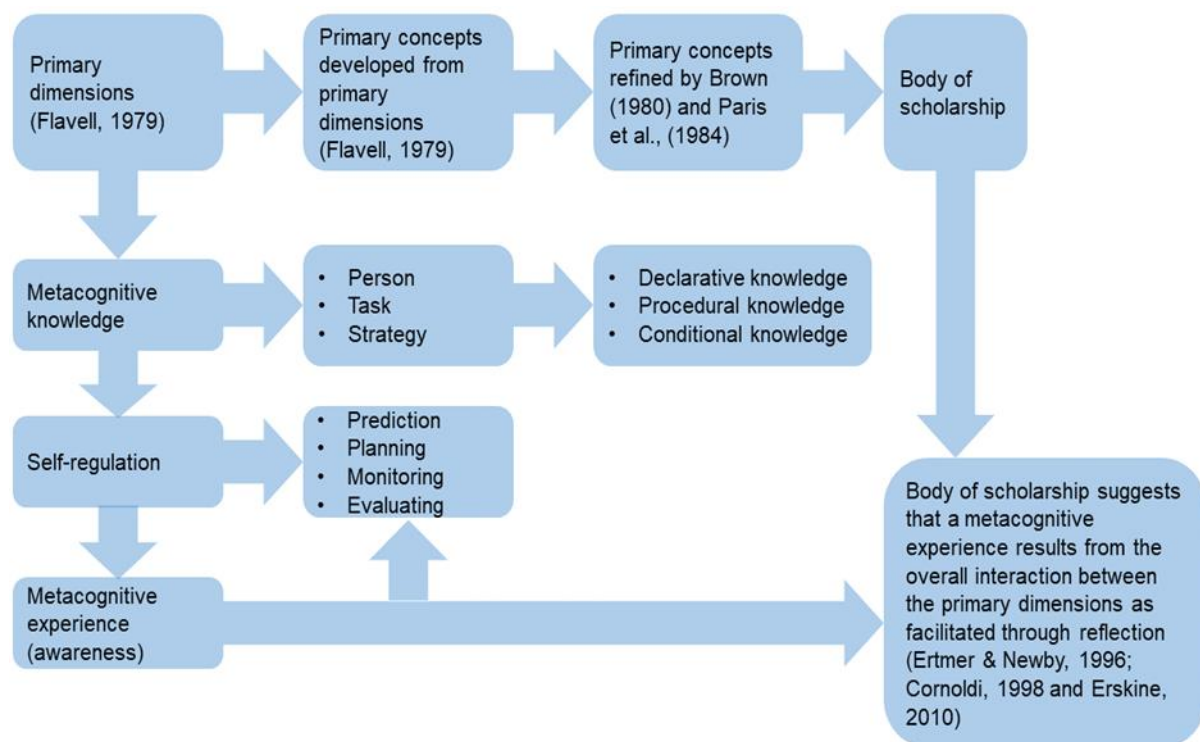


Figure 2.7: Theoretical foundations and development of metacognition

(adapted from Brown, 1980; Cornoldi, 1998; Ertmer & Newby, 1996; Erskine, 2010; Flavell, 1979; Paris et al., 1984)

The theoretical foundations and development of metacognition established the groundwork as to how different educational researchers contributed to the unique, yet fuzzy construct of metacognition. Flavell (1979) introduced two primary dimensions in metacognition: (i)

metacognitive knowledge; and (ii) self-regulation through reflection. Further research on and refinement of these primary dimensions by Brown (1980), Flavell (1979) and Paris et al. (1984) led to the development of primary concepts in these dimensions, namely (i) person; (ii) task; and (iii) strategy variables. The refinement of these concepts shed light on the importance of being aware of these processes in teaching-learning (metacognitive awareness), which is facilitated through reflection (Ertmer & Newby, 1996). When all of these primary dimensions and variables are interwoven with teaching-learning, a metacognitive experience is created where new and existing metacognitive knowledge is generated and scaffolded (Van der Walt [in press]).

In the following section, the dimensions and concepts of metacognition and how they relate to this study are discussed.

2.4.2 Dimensions and variables of metacognition

According to Flavell (1979), the nature of metacognition has two main dimensions, namely (i) metacognitive knowledge; and (ii) self-regulation, resulting in a metacognitive experience, which is facilitated by reflection (see Figure 2.8) (Efklides, 2009; Ertmer & Newby, 1996; Sabna & Hameed, 2016; Van der Walt, 2014). For the purpose of this study, metacognitive awareness and metacognition were interrelated (Sabna & Hameed, 2016). Therefore, reference is constantly made to the relationship between metacognition and metacognitive awareness in this study. Teachers are metacognitively aware when they take charge of their own learning and teaching, specifically by being aware of how they learn or teach, they constantly evaluate their learning or learners' needs and generate or choose appropriate strategies to address those needs in order to meet them (Hacker, Dunlosky & Graesser, 2009; Jaleel, 2016). Forethought and reflection as elements of metacognitive awareness support efficient and independent teaching-learning (Sabna & Hameed, 2016). Therefore, reflection (as part of metacognition) supports metacognitive awareness in strategic decision-making and utilisation of appropriate and affective strategies for teaching-learning (Ertmer & Newby, 1996; Rivers, 2001; Sabna & Hameed, 2016; Schraw & Dennison, 1994).

2.4.2.1 Metacognitive knowledge

This dimension entails knowledge about person (such as the teacher and their learners), task and strategy variables (Garcia et al., 2016) (see Figure 2.8 on p.41). According to Crescenzi (2016), knowledge about person (declarative knowledge) refers to teachers' and their own learners' knowledge of cognitive abilities, self-efficacy, motivation and interest and factors which can influence performance (Hartman, 2001). Knowledge about the task and strategies

(procedural knowledge) refers to the knowledge teachers have of their personal or others' cognition and understanding required for the cognitive level for the task (Crescenzi, 2016). Conditional knowledge (person, task and strategy) refers to declarative and procedural knowledge, allowing teachers to choose and implement appropriate teaching-learning strategies based on their own and their learners' cognitive abilities to successfully achieve lesson outcomes (Crescenzi, 2016).

2.4.2.2 Self-regulation

According to Lerner, Brindis, Batanova, and Blum (2018), self-regulation is a multidimensional construct due to its basic psychological functions as well as intentional cognitive processes. For individuals to self-regulate cognitive activities, an awareness of their own cognition (relating to decisions, strategies and outcomes) must be established (Legg & Locker, 2009). Self-regulation consists of planning, monitoring and evaluation (Basso & Abrahão, 2018). Teachers engaging in planning set specific goals that learners must meet to complete the lesson or task successfully (Zumbrunn, Tadlock, & Roberts, 2011). Teachers engaging in monitoring monitor the pedagogies they employ, the progress their learners make and their learners' engagement during the lesson or task (Zumbrunn et al., 2011). They evaluate whether learners have successfully met the goals of the task – evaluation (reflection for, in and on teaching-learning) allows for overall lesson or task improvement by the teacher to limit or prevent difficulties and misunderstandings (Zumbrunn et al., 2011).

2.4.2.3 Reflection

Ertmer and Newby (1996) state that expert learners (teachers as learners) tend to integrate their gained knowledge (referring to declarative, procedural and conditional knowledge) to deliberately plan, monitor and evaluate teaching-learning while reflecting thereupon to achieve the desired learning goal. Reflection on the process of learning is believed to be a crucial element in the development of expert learners (Ertmer & Newby, 1996). Reflection for, in and on action is regarded as a large, often subconscious, component of metacognition, linking all of its dimensions (especially metacognitive knowledge and self-regulation) together (Cornoldi, 1998; Ertmer & Newby, 1996; Erskine, 2010). According to Gravett and De Beer (2015), reflection in action refers to reflection teachers are engaged in whilst teaching and learning. Reflection on action refers to the evaluation of the teaching-learning experience afterwards, and reflection for action refers to the planning ahead to improve general teaching practice and prevent misconceptions (Gravett & De Beer, 2015). Reflection promotes self-directedness due its role in ensuring autonomous learning (Erskine, 2010).

Reflection refers to a valuable link between theory and practice where teachers structure teaching-learning experiences, assisting learners in transitioning from surface- to deep learning (Cushion, 2018; Erskine, 2010; Gravett & De Beer, 2015). According to Erskine (2010) and McAlpine et al. (1999), the value of reflection has long been recognised, allowing teachers (and learners) to engage in thinking about teaching-learning by monitoring cues and making informed decisions to adjust teaching-learning, ensuring the correct transfer of knowledge in order for learners to achieve their learning goals. Figure 2.8 illustrates how metacognitive knowledge, self-regulation for, in and on teaching-learning are interrelated.

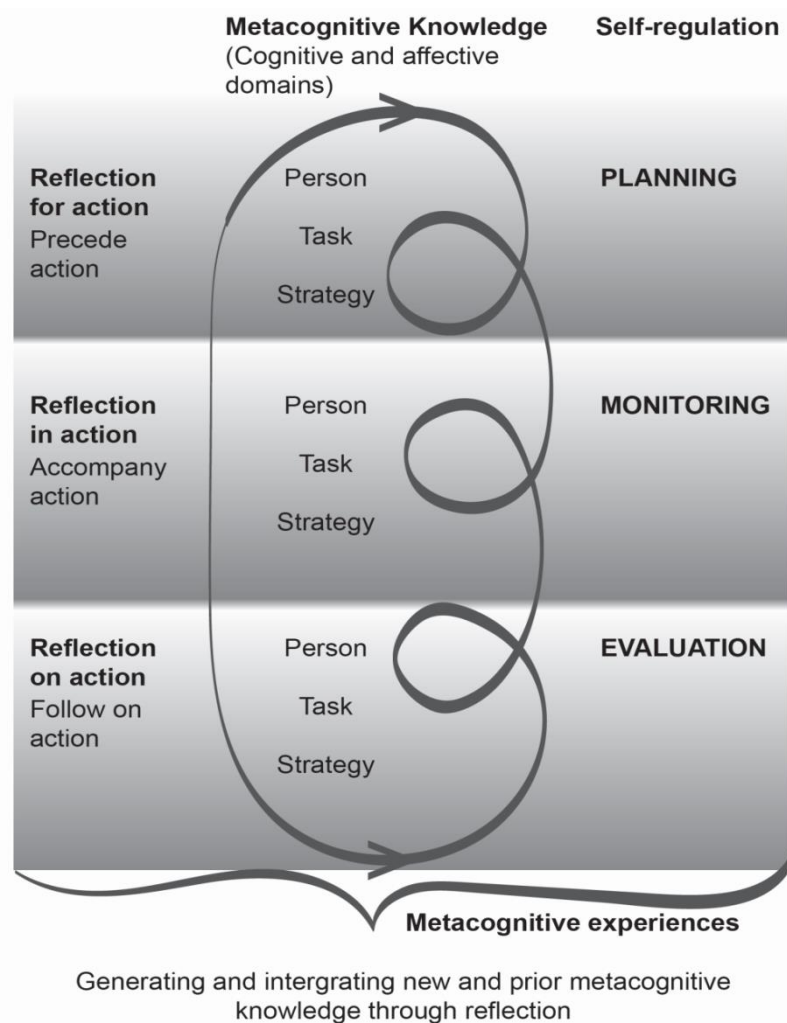


Figure 2.8: Metacognitive competency

(Van der Walt [in press])

Metacognitive knowledge and self-regulation develop to form new metacognitive experiences. Interaction between metacognitive knowledge and self-regulation is facilitated by reflection (Ertmer & Newby, 1996). Reflection is the way we teach and learn and occurs continuously (reflection for, in and on action) when teaching and learning. New knowledge is gained from

each experience, which can be transferred to similar or unfamiliar teaching-learning experiences. Reflection is a powerful link between thought and action (Ertmer & Newby, 1996). It enables teachers to retrieve information based on metacognitive experiences and to act or improve thereon for utilisation in the future (Efklides, 2006). This self-improvement in practice is the essence of SDL (Williamson & Paulsen-Becejac, 2018).

2.4.3 Self-directed learning and metacognition

Individuals who take active responsibility for their own learning, determine their learning pre-requisites, have clear goals in mind (while evaluating their learning outcomes), and choose appropriate teaching-learning strategies and resources to assist them, are considered to be self-directed learners (Bosch, 2017; Knowles, 1975).

Loyens, Magda, and Rikers (2008) state that SDL is an umbrella term and includes processes such as goal-orientation, metacognition, self-evaluation, critical thinking, and various others, all influencing the facilitation of teaching-learning. According to Havenga (2017) and Van der Walt (2014), SDL is an individual, motivated undertaking where teachers manage all aspects involved in teaching-learning, such as setting goals for the lesson, reflecting on previous teaching-learning experiences, making informed decisions to scaffold the lesson with appropriate skills and strategies in order for learners to obtain the learning goal. These much-needed skills characterise SDL, and teachers should be given the opportunity to transfer these characteristics, making them explicit in their teaching-learning practice and reflecting thereon to constantly improve for future teaching-learning endeavours (Nepal & Stewart, 2010; Van Der Walt, 2014).

As seen in the theoretical foundations of metacognition (§ 2.4.1), SDL and metacognition are interwoven. The primary concepts of metacognitive knowledge (person, task and strategy) and self-regulation (planning, monitoring and evaluation) are nested within SDL, but are fuzzy to point out, since the focus of one's research would influence one's views thereof. For the purpose of this study, the focus was on teachers (and indirectly on learners), but SDL and metacognition are interwoven as follows, based on the definitions of SDL by Flavell (1979) and Knowles (1975).

Table 2.4: The link between SDL and metacognition in this study

SDL	Metacognition corresponds with aspects such as
Diagnose teaching-learning needs	person, task, strategy prediction and planning
Formulating teaching-learning goals	task, planning and evaluation
Identifying human and material resources for teaching-learning	task, strategy and planning
Choosing and implementing appropriate teaching-learning strategies	person, task, strategy, planning and evaluation
Evaluating teaching-learning outcomes	task, monitoring and evaluation

(adapted from Flavell, 1979 and Knowles, 1975)

In Table 2.4, teaching-learning needs are diagnosed when teachers establish their own and their learners' cognitive abilities, predicting possible misconceptions to solve the problems and planning to guide the learners through it. Teaching-learning goals are formulated when the nature of the task is established. Planning can now start where the goals are aligned with evaluation principles. Resources are identified when the task is established – the teacher can now determine what resources would most likely contribute to the success in reaching the overall outcomes of the lesson, which are also part of the planning process. Appropriate teaching-learning strategies correspond to a lot of metacognitive variables. Teachers need to plan for various teaching-learning strategies due to multicultural South African classrooms. Various teaching-learning strategies also include how learners (person) learn (visual, auditory, sensory, etc.). The task should be aligned with the person concept as it could include real-life experiences of the learners, making mathematics more relevant and accessible to them. An appropriate teaching-learning strategy can also entail the integration of various calculations to solve problems, which should be made accessible to learners. Alignment of appropriate teaching-learning strategies rests on good planning and aligning them for teachers and learners to reach the teaching and learning goal of the topic being dealt with in their specific context. The evaluation of teaching-learning goals should be the main aim of the task that the teacher plans for the learners. Monitoring whether the learners are reaching the outcomes is a continuous process and can assist in avoiding misconceptions on the part of the learners. Therefore, metacognition is the “driving-force” or engine behind SDL (Shannon, 2008).

2.4.4 Possible relationship between pedagogical content knowledge and metacognitive awareness

Teachers who are metacognitively aware are able to look at (reflect on) their teaching practice from “an outsider perspective” to see what they do, how they do it, why they are doing it, and how their learners’ performance reflect on their teaching-learning praxis based on their context (Brookfield, 2017). By being metacognitively aware and reflecting on their own practice, teachers understand curriculum content better, providing them with a well-grounded rationale for teaching-learning (Brookfield, 2017). Metacognitive awareness enhances teachers’ ability to be critical analysers of their teaching-learning praxis, hence aligning and improving their PCK (Yeschenko, 2017).

Teachers who know and are aware of their strengths and weaknesses regarding their metacognitive knowledge and self-regulation would be more likely to actively monitor their own teaching and their learners’ learning by carefully selecting strategies and resources for tasks and assessing their readiness for overall improved performances (Bransford, Brown, & Cocking, 2000). Therefore, if teachers are consciously aware of how they teach and how their learners learn, they would be able to challenge their learners, resulting in autonomy in the teaching-learning process (Hacker et al., 2009; Sabna & Hameed, 2016; Veenman, Van Hout-Wolters, & Afflerbach, 2006). Table 2.5 illustrates a possible relationship between PCK and metacognition (metacognitive awareness).

				Pedagogical knowledge that is built on teachers' subject matter knowledge – PCK includes the countless intentional teaching-learning decisions teachers make from, when, after teaching mathematics content		
Metacognitive awareness				Knowledge of mathematics content and learners	Knowledge of mathematics content and teaching	Knowledge of the mathematics curriculum
	Metacognitive knowledge	Reflection	Person	* Knowledge of ways learners understand mathematics (construct mathematical content); * Knowledge of what/how learners are thinking; * Knowledge of learners' cultural backgrounds; * Knowledge of learners' different emotional needs; * Knowledge of how learners process information and what their strengths and weaknesses are.	* Teacher knows how to teach (e.g., PoP) a particular mathematics idea in ways so that learners make sense of it; * Knowledge of how teachers (themselves) impact on learners' learning and sensemaking; * Knowledge of how to look for learners who need more attention.	* Knowledge of what learners in a particular Grade have to master.
			Task	* Knowledge of ways to do mathematics content; * Teacher has sufficient knowledge of different ways learners understand particular mathematics content; * Knowledge of nonmathematical ways to teach mathematics content without understanding.	* Knowledge of how to teach mathematics (e.g., PoP) so that it makes sense to particular learners; * Sequencing mathematics concepts and knowing why various/different ways of doing mathematics are correct; * Knowledge of what and how to prompt all learners to think mathematically; * Knowing how to give feedback to learners' responses/thinking; * Knowing when to give new/different activities.	* Knowledge of the type of tasks learners have to be able to do in a particular Grade; * Knowledge about my own weaknesses and strengths as a teacher; * Knowledge about myself as a teacher and a lifelong mathematics learner; * Knowledge of time limitations for teaching-learning particular mathematics content/topics; * Knowing available resources to implement.
			Strategy	* Knowledge of ways learners learn and understand mathematics content; * Choose instructional activities to support learners' understanding or sensemaking.	* Knowledge of ways to teach mathematics (e.g., PoP) for understanding and sensemaking; * Knowledge of how to teach learners to receive and act on feedback; * Knowing about teaching-learning strategies to consolidate mathematics content that has been learned. * Conditional knowledge referring to what we know about conditions under which we can implement various strategies.	* Knowledge of available and appropriate teaching-learning strategies; * Knowing what resources and representations would be most appropriate for your learners to make sense of the mathematics content.
	Self-regulation		Planning	* How would I teach mathematics content (topic) to ensure understanding in a particular Grade or for learners to make sense of mathematics content?	* Knowledge of how to teach mathematics (choose from available teaching-learning strategies the most appropriate one) so that it makes sense to particular learners; * Teacher makes choices about what mathematical representations are likely to be well-understood (or misunderstood).	* Knowledge of the learning trajectory of mathematics content in CAPS (DoE, 2011) over Grades and phases – What should learners know and how what you are teaching will be building blocks for future Grades/phases * Involves planning out of a cognitive task by selecting appropriate strategies and cognitive resources.
			Monitoring	* What mistakes/misconceptions do learners have?	* Knowledge of when your own/other's teaching mathematics (e.g., PoP) makes sense or does not make sense to particular learners.	* Knowledge of how to monitor learners' understanding and sensemaking during the presentation of a lesson; * Knowledge of how to know when the chosen strategy is not contributing to sensemaking; * How to think on your feet.
			Evaluation	* What worked during the lesson and why did it work?	* Knowledge of ways learners understood mathematics content from previous experiences or what will work in future due to present experience.	* Knowing from previous and current teaching-learning experiences for future teaching experiences

Table 2.5: Synthesis between PCK and metacognition

In table 2.5, PCK (see § 2.3.1) refers to the ability of teachers to transform the mathematics content into pedagogically powerful parts (relating to the elements as proposed by Ball et al., 2004 and Shulman, 1987) that are adaptive to learners' varied abilities in order to reach understanding (Turnuklu & Yesildere, 2007). Pedagogical content knowledge and subject knowledge merge to form PCK and cannot be separated when intermediate phase mathematics teachers plan their lessons (Gravett & De Beer, 2015). Similarly, metacognition is also merged throughout the construct of PCK (see Table 2.4). In order for teachers to have a good comprehension of their own PCK and metacognition or metacognitive awareness (these concepts are used interchangeably), professional development is necessary to assist them and make them aware of these elements. Teacher professional development is discussed in the next section.

2.5 TEACHER PROFESSIONAL DEVELOPMENT

2.5.1 Theoretical foundations and development

Teacher professional development can be defined as teachers' learning – referring to how they learn to learn and how they apply this newly gained knowledge in their teaching-learning praxis to support their learners' learning (Postholm, 2012). In this study, teacher professional development refers to in-service teachers who completed their basic training and is currently teaching.

Teacher professional development can occur through participation in various courses or programmes, and when these teachers return to their respective schools, they can transfer new knowledge and principles and reflect on, adapt and renew their personal teaching-learning praxis (Postholm, 2012).

2.5.1.1 Socio-cultural theory

According to Vygotsky (1978), the thoughts and ideas behind socio-cultural theory indicate that teachers' learning is situated. Human learning is a social process and plays a fundamental role in cognition development (Vygotsky, 1978). Vygotsky believed that new knowledge is gained based on interaction with others before being integrated into one's own mental structure. Socio-cultural theory led to the introduction of the zone of proximal development (ZPD). The "zone" is an area that needs to be explored, but for which the learner needs to be cognitively prepared – social interaction is required to fully develop this zone of the learner (Postholm, 2012; Vygotsky, 1978). Teachers provide the learner with additional scaffolding to support this growth in knowledge in order for the learner to acquire the designated skill (Briner, 1999; Postholm, 2012; Vygotsky, 1978).

Based on this argument by Vygotsky's theory on socio-culturalism, Warford (2011) noted that, when teachers are professionally developed, they need an opportunity to reflect on their previous knowledge and with the assistance of competent others, proximal development would take place. This allows for a distance to emerge between teachers' current level of development and their potential development (Vygotsky, 1978). Warford introduced the zone of proximal teacher development (ZPTD), and its link to professional development in this study is discussed next.

2.5.1.2 The zone of proximal teacher development

The ZPTD refers to the distance between teachers' actual development (what teachers are able to accomplish without the help of knowledgeable others) and potential development "proximal development" (where teachers might attain valuable teaching-learning strategies facilitated by capable others) (Warford, 2011). According to Warford (2011), the ZPTD can be navigated by structuring learning interventions according to four stages, namely: (i) self-assistance; (ii) expert other assistance; (iii) internalisation; and (iv) recursion. These stages are closely aligned with teacher professional development and can be defined as follows:

- (i) Self-assistance refers to what takes place based on prior experiences and beliefs about teaching-learning in the classroom environment. The first stage is the departure point as it refers to the teacher's actual level of development (Fani & Ghaemi, 2011; Warford, 2011).
- (ii) Expert other assistance refers to the assistance (mediation) given by knowledgeable others, deepening and activating improved reflection on teaching-learning praxis (Fani & Ghaemi, 2011; Warford, 2011).
- (iii) Internalisation refers to the repeated application of newly attained knowledge, referring to pedagogical concepts. If there is capacity for teachers to reflect on and demonstrate their newly attained knowledge, internalisation allows for internal growth of the teaching-learning praxis with regard to the pedagogical concepts (Fani & Ghaemi, 2011; Warford, 2011).
- (iv) The recursion stage refers to the final stage of teacher development where the prior stages are retraced, reflected on and repeated, allowing a smoother utilisation of the newly gained pedagogical concepts and response to teaching-learning (Fani & Ghaemi, 2011; Warford, 2011).

According to Fani and Ghaemi (2011), certain factors influence the ZPTD, namely peers, mentors, mediatory resources and contextual constraints. Teachers often benefit from peer support and encouragement as they tend to lose their self-confidence when applying new knowledge and strategies in the classroom (Fani & Ghaemi, 2011). Mediatory resources are problematic in South

African schools, since a lack of resources (especially textbooks) is of great concern (Molapo & Pillay, 2018). According to Molapo and Pillay (2018), this places a damper on successful curriculum implementation and is a challenge as professional development for teachers caters for resourced schools and not really for underresourced classrooms (OECD, 2012). Importance is also placed on contextual constraints as the norms imposed by the schools in which teachers function as well as micro- and macro-influences (social, economic and political) narrow teachers' teaching-learning goals and personal choices, enabling the bridging of a Western curriculum to a certain context (Fani & Ghaemi, 2011).

Schools are very dynamic by nature, leading to a constant "re-shaping" of teacher professional development programmes to fit the needs posed by 21st-century teaching-learning (Girvan et al., 2016). Therefore, the ZPTD is an ideal model for teacher professional development as it provides "practice" opportunities where teachers apply theory to their teaching-learning praxis (De Beer & Kriek, 2018). Interventions reported by De Beer and Kriek (2018) utilised the principles of ZPTD as described by Warford (2011), leading to more successful integration and application of new knowledge by teacher participants.

Interventions aimed at improved teaching-learning practices should: (i) identify problems central to teaching-learning practice; and (ii) devise a pedagogy assisting teachers to infuse these new ideas into their classrooms (Kennedy, 2014). The ZPTD addresses each of these elements proposed by Kennedy (2014). The problems central to the teaching-learning of mathematics in the intermediate phase (as discussed in § 2.2.3) have already been identified, and (ii) puppetry as PoP could assist participants in this study to infuse a new and fresh strategy into the teaching-learning of mathematics, making it an enjoyable and fun school subject.

It is essential that teachers are afforded the opportunity to experiment, practise and reflect on their teaching-learning experiences with the tools (such as puppets) (which were provided to participant-teachers in this study during the intervention) (Girvan et al., 2016). Teacher professional development in South Africa faces many challenges, which is discussed in the next subsection.

2.5.2 Teacher professional development in context

Teacher professional development in South Africa is mandated from national policies and legislation. The South African Council for Educators (SACE) functions as a body that promotes, develops and maintains continuing professional development of all educators to provide quality education (SACE, 2016). The mandate of SACE led to the development of the Integrated Quality Management System (IQMS) to further develop the competencies of teachers (Tsotetsi &

Mahlomaholo, 2013). The developing of competencies and continuation of teacher professional development are key, since training and development in the implementation of the curriculum is the cornerstone (Tsotetsi & Mahlomaholo, 2013).

Curriculum reform in South Africa based on two newly introduced curriculums in a brief period, one after the other, was unprecedented (Ono & Ferreira, 2010). Outcomes-based education (OBE) and Curriculum 2005 (C2005) led to a huge gap between the aims and what a majority of teachers had been trained for (Bantwini, 2010; Ono & Ferreira, 2010).

The OBE curriculum (implemented in the late 1990s) differed from South African teachers' earlier experiences and teacher professional development was necessary for its implementation (Chisholm & Leyendecker, 2008; Ono & Ferreira, 2010). Soon after the implementation of OBE, C2005 was introduced, which led to a second phase of teacher professional development. Its implementation was hampered, facing several factors, one of which was inadequate teacher professional development (Ono, & Ferreira, 2010). In 2012, the Curriculum Assessment Policy Statement (CAPS) was introduced. Its implementation was also plagued by challenges like teachers being frustrated with its implementation due to a lack of theoretical knowledge (DoE, 2011; Maharajh, Nkosi, & Mkhize, 2016).

Curriculum reform in South Africa influenced the quality of teaching, which can be directly linked to teacher professional development (Van der Berg et al., 2011; Pitsoe & Maila, 2012). In their study, Kriek and Grayson (2009) found that teacher professional development should occur along three dimensions, namely: (i) content knowledge; (ii) teaching approaches; and (iii) professional attitudes. According to Pitsoe and Maila (2012), the quality of education is linked to holistic teacher professional development, which is based on Kriek and Grayson's (2008) findings, namely: (i) the "self" (professional attitudes); (ii) content knowledge; (iii) the environment; and (iv) PCK.

Pitsoe and Maila (2012) emphasise that South African teachers need to be equipped with skills in leadership and classroom management, curriculum- and policy issues and implementation, organisational interrelationships and quality assurance, which would allow them to cope with the challenges posed by CAPS (DoE, 2011). According to De Beer and Kriek (2018), there are certain issues revolving around in-service teacher education in South Africa such as transmission-mode teaching-learning practices. Teacher professional development is necessary to change this method of teaching-learning (De Beer & Kriek, 2018).

2.6 Chapter summary

In this chapter, literature was consulted to discuss school mathematics (focusing on the intermediate phase) in South Africa. Teachers' PCK were also discussed based on its overall nature nested in MKT. In PCK, PoP resides where puppetry is but one strategy that teachers can use in the intermediate phase mathematics classroom to make mathematics accessible to all learners. Lastly, metacognition was discussed, which features as the overarching construct in this study. Metacognition binds the other constructs together, since the awareness teachers have when planning lessons, integrating MKT and specific PCK for script writing and infusing their lessons with a PoP (puppetry) is a self-directed process, facilitated by reflection. The constructs in Chapter 2 are illustrated in Figure 2.9.

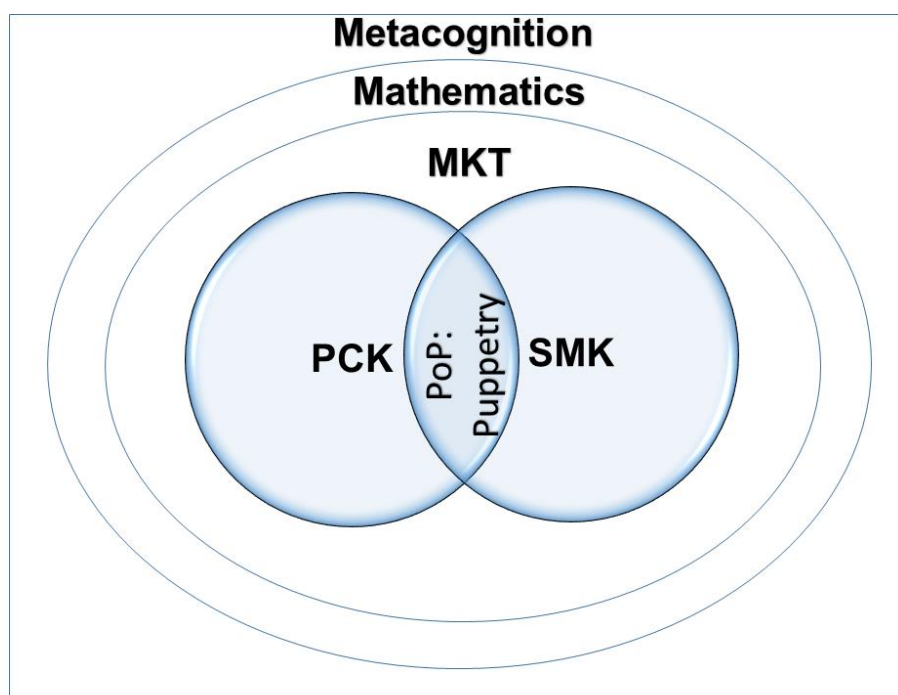
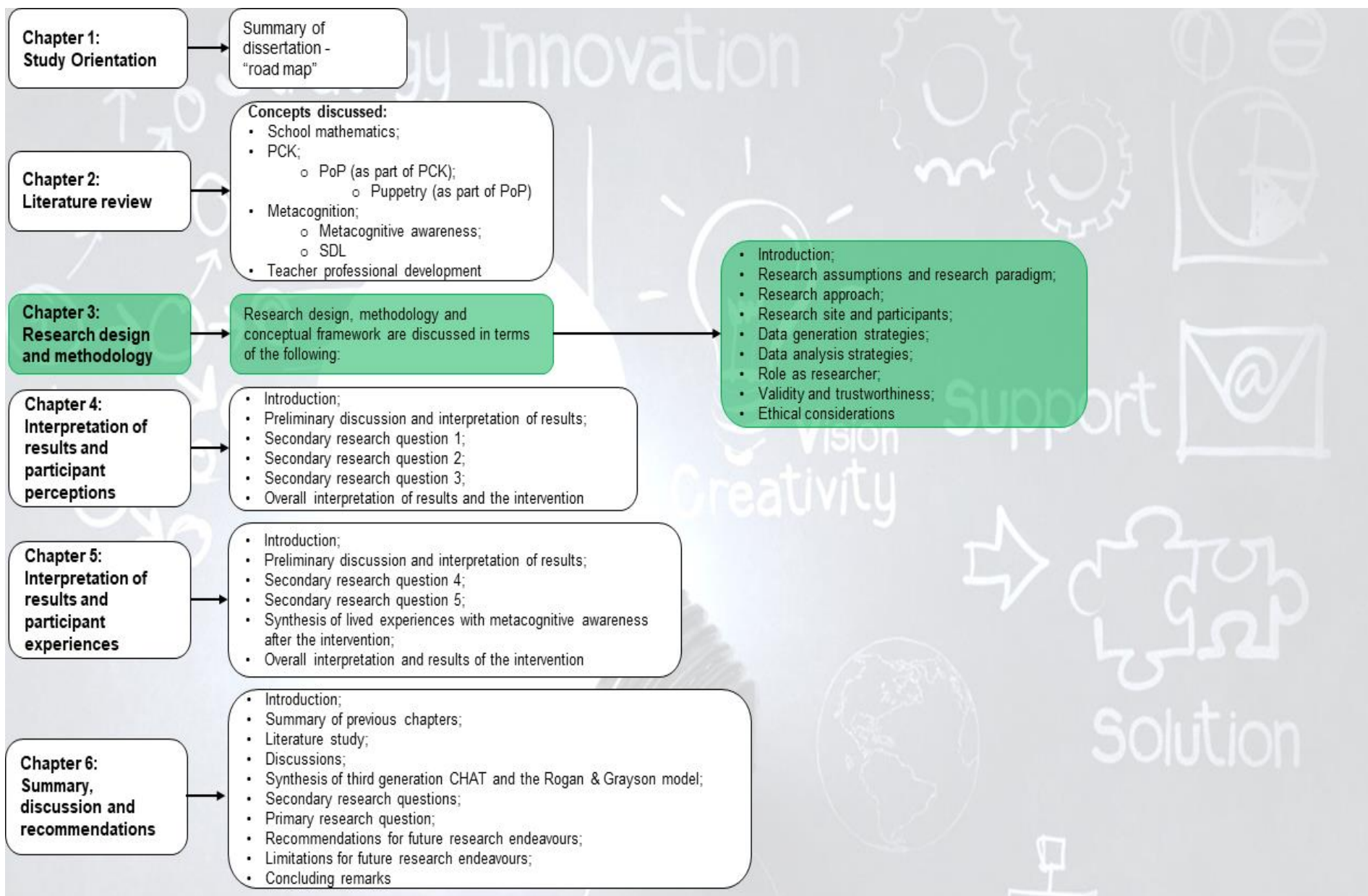


Figure 2.9: The constructs utilised in this study

For the purpose of this study, metacognition overarches MKT. PCK and SMK resides in MKT. Teachers' PCK allows them to integrate strategies like PoP (puppetry) where script writing is employed, integrating all mathematical elements and principles of certain mathematical topics that should be covered in intermediate phase school mathematics. In the next chapter, the research design and methodology are discussed in more detail.

“When we read great literature, something changes in us that stays changed. Literature remembered becomes material to think with” (Donald Hall)



CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter provides insight into the research paradigm, research approach, research design and methodology, trustworthiness and ethical considerations applicable to this study. I discuss my role as researcher in this study. I focus on the research site and participants, and the data generation and analysis strategies in this study are also discussed.

3.1.1 Research design, methodology and conceptual framework

The research design and conceptual framework inform the methodology. Figure 3.1 illustrates the research design of this study.

Social constructivism was the overarching theoretical framework (Figure 3.1) in this study. In combination with social constructivism, CHAT was applied, as conceptualised by Engeström (1987), and integrated with the Rogan and Grayson (2003) model. The conceptual framework consisted of school mathematics, PCK, PoP as strategy in which puppetry resides as tool, and metacognitive awareness and its relation to PCK and SDL and the intervention which served as overall professional development. Qualitative data collection methods entailed semi-structured open-ended individual interviews prior to workshop one; reflections participants completed (reflective prompts) based on the workshop presentations and activities done throughout both workshops; observations during both workshops; a focus group interview after the second workshop; and reflective journals indicating their transfer of the knowledge gained through the intervention to their respective intermediate phase mathematics classrooms. Data were analysed by means of hermeneutical data analysis and narrative analysis. Findings are discussed in Chapters 4 and 5. Figure 3.1 illustrates the development and refinement of the research design (informed by social constructivism as theory nested in an interpretivist paradigm) and how the research design, methodology and conceptual framework are interrelated.

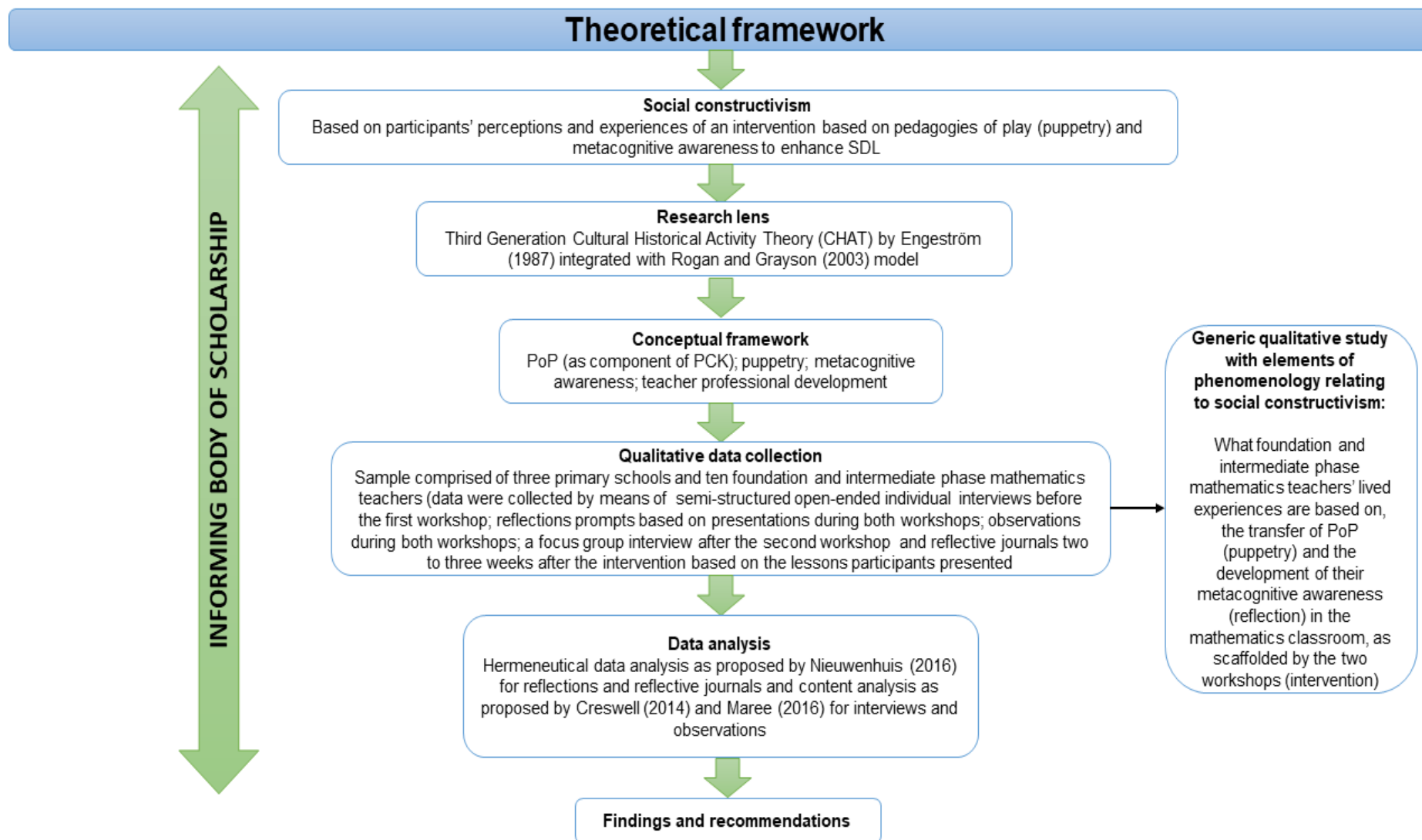


Figure 3.1: Theoretical framework and research design of this study

For the sake of the reader, Table 3.1 serves as a synthesis of the four phases of this research used in this study. The presentation of these phases can be found in this chapter in sub-section 3.5.5.1. An intervention was conducted – focusing on the professional development of intermediate phase and foundation phase “backup” mathematics teachers – to explore and describe how a PoP (puppetry) could enhance participating teachers’ metacognition (metacognitive awareness), which contribute to their overall PCK and SDL. According to Hix (2008), “[i]t is an experience in metacognition, to hold the act of teaching out at a distance, to look at it from all different perspectives (metacognitive awareness), and then to place the teacher back into the act of teaching to monitor what happens” (p. 121).

Table 3.1: Interrelatedness of research design, methodology and conceptual framework in this research study

Primary (overarching) research question	What are intermediate phase mathematics teachers' lived experiences of an intervention based on a PoP (puppetry) and metacognitive awareness to enhance SDL?			
Research question pertaining to phase	* Secondary research question 1: What are intermediate phase mathematics teachers' perceptions of PoP (puppetry) before and during the intervention? * Secondary research question 2: What are intermediate phase mathematics teachers' perceptions of metacognitive awareness before and during the intervention?	* Secondary research question 1: What are intermediate phase mathematics teachers' perceptions of PoP (puppetry) before and during the intervention? * Secondary research question 2: What are intermediate phase mathematics teachers' perceptions of metacognitive awareness before and during the intervention?	* Secondary research question 3: How do intermediate phase mathematics teachers prepare lesson plans and puppetry scripts to implement in their classrooms before and during the intervention?	* Secondary research question 4: What are intermediate phase mathematics teachers' lived experiences of the transfer of PoP (puppetry) after the intervention? * Secondary research question 5: What are intermediate phase mathematics teachers' lived experiences of the transfer of metacognitive awareness after the intervention?
Phases	Phase 1: Prior to Workshop 1	Phase 2: During Workshop 1	Phase 3: During and after Workshop 2	Phase 4: After intervention
Data generation strategy	* Semi-structured open-ended individual interviews prior to workshop one	* Orientation workshop based on PoP (puppetry) and metacognition (metacognitive awareness) and reflections as an aspect of metacognition thereon. * Participants also received puppets at this workshop.	* Script writing and lesson planning workshop. Participants once again answered reflective prompts that were provided. * Observations were made of teachers while writing scripts and infusing it into their lessons * A focus group interview was conducted after this workshop.	* Reflective journals based on participants' implementation of lesson plans and puppetry scripts
Description of phase	* The focus of these interviews was to gather data on participants' perceptions prior to workshop one based on PoP (puppetry); * How they planned, identified misconceptions and reflected on lessons and learners as part of their current teaching-learning strategies (metacognitive awareness)	* Participants answered reflective prompts that were provided	* Participants shared their experiences of the introduction of their puppets to their learners. * Participants engaged in enacting scripts. * Participants then engaged in script writing and planned a lesson due to be taught in the following two weeks	* Participants received both a hard copy and e-version of the reflection journal template. * For the reflective journal they had to respond to 16 prompts, assisting them to reflect adequately on their teaching-learning experience with a PoP (puppetry) in their respective classrooms.

Based on Table 3.1, here follows a brief presentation of how the first workshop in this intervention, was conducted (Table 3.2).

Table 3.2: Workshop one of the intervention

Activity	Description of activity
Mathematics on a Shoestring examples	Tshimologo Mathematics Shoestring Kit (TMSK®) was showcased and participants got to experience how mathematics can be taught by employing boomwhackers and indigenous games like Morabaraba and links to CAPS
PoP presentation	Participants were walked through what PoP entails (various forms), how puppetry is nested therein and how it links to storytelling (as point of departure for script writing).
Reflective prompts	Participants completed reflective prompts based on the presentation of PoP (puppetry).
Presentation on metacognitive awareness	Participants experienced a presentation on metacognition with regard to its “fuzzy” construct and what it entails (metacognitive knowledge, self-regulation, metacognitive awareness) and how all of these concepts align with teaching-learning.
Reflective prompts	Participants completed reflective prompts based on the presentation on metacognition.
Guidelines for workshop two of the intervention	Participants were prepared for what to expect and what to bring with for workshop two. Participants also received a puppet which they could then “experiment” with in their respective mathematics classrooms and report back during workshop two.

Workshop one began at 08:30 and ended at 14:00. During workshop one, participants were introduced to various other cost-effective tools (TMSK®) and strategies to make teaching-learning in the mathematics classroom accessible to all learners. The two main presentations on PoP (puppetry) and metacognition followed, which served as an orientation workshop for the participants on these two concepts. Reflective prompts were provided after each presentation and enough time was allocated for participants to ask questions about and/or for assistance with the prompts. Guidelines for the second workshop were discussed before the closure of workshop one. Here follows a brief description of workshop two (Table 3.3).

Table 3.3: Workshop two of the intervention

Activity	Description of activity
Discussion of ideas from previous session to date	Participants shared experiences on how they introduced their puppets to their classroom and how learners reacted towards the new “peer”.
Videos	YouTube videos were shared with participants before workshop two, but were viewed and discussed during this session on how to use puppetry (tips from teachers using it in praxis) and overall tips on the integration thereof.
Mini puppet show	Participants were provided with four puppetry scripts of which they had to perform a mini skit based on these scripts.
Reflective prompts	Participants completed reflective prompts based on the mini puppet show they enacted.
Lesson planning and writing of scripts	Participants engaged in an adapted lesson study on the planning of their lessons and the writing of their puppetry scripts.
Guidance on reflective journals and additional tips on overall infusion of puppetry in the mathematics classroom	Participants were given guidance on their reflective journals, the successful completion thereof and were given overall tips on their endeavour to teach with a PoP (puppetry) in intermediate phase mathematics.
Focus group interview	Participants shared their experiences of PoP (puppetry), metacognition and the intervention overall.

Workshop two began at 08:30 and ended at 14:30. During workshop two, participants discussed their experiences of the introduction of their puppets in their respective mathematics classrooms. Ideas were shared on teaching-learning strategies with puppets as they transferred what they had learned about puppets in the first workshop to their classrooms. Puppetry videos on YouTube regarding the application of puppets and other ideas shared from teaching-learning praxis as to the integration of puppetry in lessons were shown to participants. These videos were also shared with participants before the second workshop. Participants then engaged in a mini puppet show where they were provided with four puppetry scripts which they had to perform in groups. Three of the four puppetry scripts were based on indigenous stories which participants had to mathematise themselves. The fourth script was a working example as to how a puppetry script looks like when mathematised for an intermediate phase mathematics lesson. Participants completed reflective prompts based on this experience of enacting their skits. They then engaged in an adapted form of lesson study. They brought all the materials, such as the CAPS (DoE, 2011) document, lesson plan templates, textbooks, and their intervention booklets (consulted for prompts as to the writing of scripts) they needed for lesson planning. My study supervisor and I acted as facilitators and

assisted participants in the process of writing, mathematising and integrating scripts with existing lesson plans. The participants were given guidance on the completion of the reflective journals. The focus group interview met afterwards.

3.2 Research assumptions and research paradigm

Creswell (2014) states that a research paradigm is a general philosophical view that researchers have about the world. The research paradigm influences the nature of the research being done (Creswell, 2014). This generic qualitative study (see § 3.3), with elements of phenomenology, was underpinned by an interpretivist paradigm. An interpretivist paradigm aims at understanding how the experiences of individuals influence their reality (De Vos, Strydom, Fouché, & Delport, 2015). According to Nieuwenhuis (2010), a paradigm “addresses fundamental assumptions taken on faith, such as beliefs about the nature of reality (ontology) – participant perceptions of PoP (puppetry) and metacognition, the relationship between the knower and known – the experiences gained based on the intervention (epistemology) and assumptions about methodologies – transferring the knowledge gained to participants’ respective mathematics classrooms” (p. 47). The assumptions of this study are discussed next.

3.2.1 Research assumptions

As individual and researcher, my experiences and knowledge form an essential part as to how I interpret the results of the study. The ontology of my study was subjective to my personal involvement in the process of exploring and describing the implementation of PoP (puppetry) influencing participants’ metacognition (metacognitive awareness) of their planning, monitoring, evaluating and reflection of and on their daily teaching-learning praxis. My goal was to depend on intermediate phase mathematics teachers’ views, perceptions and experiences of the phenomenon under study (Creswell, 2014). The epistemology of this study relied on how teachers integrated a PoP (puppetry) in the intermediate phase mathematics classroom by aligning the mathematics content with learners’ real-life experiences and what metacognitive skills, if any, they had implemented before, during and after the intervention.

The ontological and epistemological assumptions influence the methodological assumption that teachers attach certain meaning to their reality (such as daily teaching-learning) where contextualisation and mathematisation of mathematics content occur with puppetry in order to assist learners in linking subject content to their everyday lives or real world. The research paradigm is discussed in the next section.

3.2.2 Research paradigm: social constructivism

The qualitative nature of this study needed an interpretivist research paradigm, which is rooted in social constructivism theory as described by Vygotsky (1989). Social constructivism emphasises the importance of culture and context to gain an understanding of a phenomenon (Adam, 2017; Vygotsky, 1989) – in this case, teaching-learning praxis in the intermediate phase mathematics classroom. Interpretivism is therefore constructed in a social manner and cannot be objectively determined (Nieuwenhuis, 2010). Teaching-learning praxis places teachers in a social environment, creating certain perceptions and ideologies of daily teaching. Perceptions and ideologies influence how teachers are guided by principles of how learners learn mathematics and how they (teachers) are supposed to teach the subject (Olivier, 1989). The social environment of the intervention also allowed the participants to explore their ideologies and perceptions.

Social constructivism and mathematics teaching require teachers to approach their teaching-learning praxis by taking learners' social environment and culture into account. By considering teaching-learning this way, teachers can contextualise and mathematise school mathematics by making use of PoP to make mathematics understandable and meaningful for their learners.

Social constructivism theory as theoretical framework provides a comprehensive conceptual understanding of how teachers interact in their teaching-learning praxis (Reeves, Albert, Kuper, & Hodges, 2008). Two lenses were employed in the theoretical framework of this study. The first was third-generation CHAT as conceptualised by Engeström (2001) and, secondly, the Rogan and Grayson (2003) model. The integration of third-generation CHAT and the Rogan and Grayson model was employed successfully in studies done by Petersen (2011) and White (2012). The authentic application of these two lenses by these authors provided me with more insight as to how I could integrate them into this study.

Third-generation CHAT supports the notion of context and is concerned with how individuals understand, explain and interpret real-life situations (Roth, Lee, & Hsu, 2008). In this study, context played a vital role. The participants (from rural and township schools) taught learners who were immersed in different contexts and who experienced different real-life situations. In order to strengthen the theoretical framework of my study, I integrated Rogan and Grayson's (2003) model with third-generation CHAT. This model is based on implementation on a larger scale (the implementation of Curriculum 2005). I decided to integrate it into my research as the focus of my study entailed how participants transferred a new teaching-learning strategy like PoP (puppetry) to their mathematics classrooms, contributing to their overall PCK. The

following two subsections provide more detail on these two lenses and how they are interrelated (see § 3.2.2.3).

3.2.2.1 Third-generation cultural-historical activity theory

Third-generation CHAT theory has underlying concepts in its construct: in this study, the *subject* (participants) integrated *tools* (PoP – puppets) to obtain an *object* (teaching-learning goal) in an activity system. The activity system refers to a certain setting influenced by *rules* (policies) and the surrounding *community* (role players in/around the school), each with their own *division of labour* (role to fulfil) (Mentz & De Beer, 2017). Two activity systems were employed in this study, namely (a) participant perceptions before and during the intervention; and (b) participants' experiences after the intervention.

The way in which third-generation CHAT was employed in this study was authentic and is illustrated in Figure 3.2.

Key:

T – Tools
S – Subject
R – Rules
C – Community
D – Division of labour
O – Object

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See Chapter 6, table 6.2

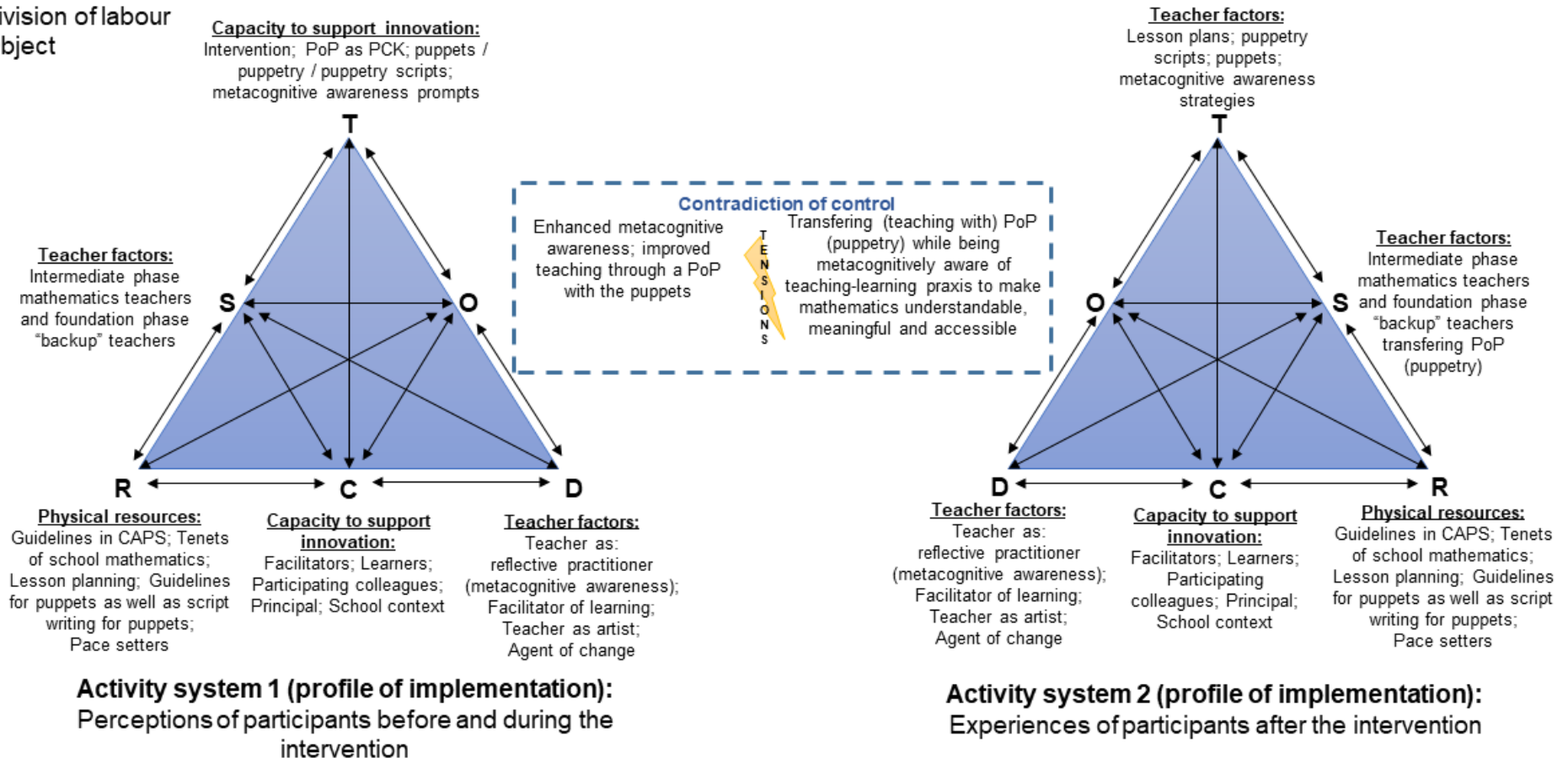


Figure 3.2: Third-generation CHAT employed in this study

(adapted from Mentz & De Beer, 2017)

In activity system one, the intervention (workshops one and two) were related to the following concepts of third-generation CHAT.

- (i) *Tools [capacity to support innovation]:* In order to obtain the object of the intervention, the professional development workshops (featuring as a capacity to support innovation [Rogan & Grayson, 2003]) were employed as tools where PoP (puppetry) was introduced to the participants, who collaborated in the form of adapted lesson study to infuse lesson plans for existing mathematics content, which they still had to teach with a PoP (puppetry) while being made metacognitively aware of what they were doing, why they were doing it and how they were doing it. A PoP (puppetry) and metacognitive awareness as tools served as an extension of participants' PCK (see Chapter 4, §§ 4.3; 4.5 and 4.7).
- (ii) *Subject [teacher factors]:* The subject of study in this research was intermediate phase mathematics teachers (Grades 4 to 6) as well as foundation phase teachers (Grades 1 to 3) who acted as "backup" teachers in the absence of intermediate phase teachers at each of the three schools involved in this study. These foundation phase teachers were also involved in the teaching-learning of intermediate phase mathematics and participated willingly. The subjects in this study and the way in which they implemented a PoP (puppetry) were based on teacher factors (Rogan & Grayson, 2003) such as personal background, level of training and teaching-learning confidence, and years of teaching-learning mathematics (see Chapter 4, §§ 4.3; 4.5 and 4.7).
- (iii) *Rules [physical resources]:* The rules that governed this activity system was the CAPS (DoE, 2011) curriculum for intermediate phase mathematics. The CAPS document – which serves as these participants' ultimate rule for teaching-learning – was one of the first resources to surface. The tenets of school mathematics refer to the beliefs held by these participants of the teaching-learning of intermediate phase mathematics. Lesson planning occurred in an adapted lesson study approach where participants collaborated with one another in studying the chosen topics on which they planned the lesson, assisting each other in the formulation and scaffolding thereof. Participants were given guidelines on writing scripts for puppets and we assisted them (during workshop two) in the formulation thereof to transfer during the teaching-learning of their planned lessons. These guidelines supported participants' innovative strategies and were merely there to guide them. The way in which participants made the link on how to integrate puppetry into their CAPS (DoE, 2011) content were based on their knowledge of the tenets of school mathematics. Participants also brought a few textbooks they had used for additional ideas on content and ways in which they could mathematise the puppetry

script. The rules participants employed during the intervention were in the form of physical resources (Rogan & Grayson, 2003) in order for teaching-learning with a PoP (puppetry) to be implemented (see Chapter 4, §§ 4.3; 4.5 and 4.7).

- (iv) *Community [capacity to support innovation]:* My supervisor and I acted as facilitators for these participants, scaffolding their learning processes as teachers and as learners themselves during this intervention. Their own learners were the “audience” to whom they had to present their lessons in their respective classrooms. The principal at each of these schools acted as a supportive role player in participants’ school community as they allowed for the research to commence (allowing me to inform teachers about the study where they voluntarily agreed to participate) and afforded these teachers the opportunity for further professional development, which could enrich their learners’ learning and understanding. Participants identified human (peer participants) and material resources to enhance teaching-learning, indicating self-directed behaviour (Knowles, 1975; Van der Walt, 2014). It is important to note that participants did not know each other at the first workshop; they sat with their colleagues from their own schools. As workshop one of the intervention progressed, participants acted as a community (which can also be seen as a physical resource), since they quickly realised how much they had in common with regard to the areas (contexts) of their schools and overall challenges they faced together, albeit in their respective schools. The community of support for these participants acted as a capacity to support innovation (Rogan & Grayson, 2003) as they interacted with one another and shared ideas during the intervention (see Chapter 4, §§ 4.3; 4.5 and 4.7).
- (v) *Division of labour [teacher factors]:* The participants fulfilled the roles as facilitators to each other and reflective practitioners, since they engaged in deep discussion on the planned lessons. The participants reflected on their own experiences with teaching-learning and supported each other with ideas and valuable inputs, providing an overall positive environment in which they learned more from one another. The division of labour was based on the subjects, who had to engage in teaching-learning with a PoP (puppetry), once again dependent on teacher factors (Rogan & Grayson, 2003), in order to accomplish the object (outcome) after the intervention in their respective intermediate phase classrooms (see Chapter 4, §§ 4.3; 4.5 and 4.7).
- (vi) *Object:* The object and prolonged outcome of this intervention was that participants were imparted knowledge and understanding of PoP (puppetry) while being metacognitively more aware when planning, monitoring and evaluating future lessons infused with a PoP

(puppetry), affording learners enhanced access to meaningful mathematics (see Chapter 4, §§ 4.3; 4.5; 4.7 and 4.9).

For the sake of the reader, activity system one is based on secondary research questions one to three.

In activity system two (after the intervention), the participants' experiences with teaching with puppets pertained to the following concepts of third-generation CHAT.

- (i) *Tools [capacity to support innovation]*: In order to obtain the object of the goals for teaching-learning in the participants' respective classrooms, the developed lesson plans, puppetry scripts and puppets were integrated, while being metacognitively aware of teaching-learning before, during and after the presentation of their lessons. The intervention assisted participants to be creative and innovative in their teaching-learning praxis, hence allowing for a capacity to support innovation (Rogan & Grayson, 2003) in their respective intermediate phase mathematics classrooms (see Chapter 5, §§ 5.3 and 5.5).
- (ii) *Subject [teacher factors]*: The subject of study in this research was intermediate phase mathematics teachers (Grades 4 to 6) and the "backup" foundation phase teachers who utilised a PoP (puppetry) for teaching-learning (see Table 3.6). Seven (N=7) of the 10 (N=10) participants engaged in the teaching-learning of their lessons infused with a PoP (puppetry) and teacher factors (Rogan & Grayson, 2003) determined their experiences of and with a PoP (puppetry) in their classrooms (see Chapter 5, §§ 5.3 and 5.5).
- (iii) *Rules [physical resources]*: The rules governing this activity system was the same as those in the first activity system (Rogan & Grayson, 2003), but the way in which participants integrated rules in order for teaching-learning with a PoP (puppetry) to be implemented, was different, as reported in Chapter 5 (§ 5.5).
- (iv) *Community [capacity to support innovation]*: The learners were still the "audience" to whom the participants had to present their lessons during their teaching-learning with PoP as strategy, serving as a very important aspect in this activity systems' community. Fellow colleagues at the school may have provided support for these teachers who participated in this research. The principal fulfilled a supportive role allowing these participants to participate in this research. As two rural schools and one township school were part of this study, the surrounding community of the participants' respective schools influenced how they contextualised their lessons for the learners in their own

classrooms (Rogan & Grayson, 2003), making intermediate phase mathematics understandable and meaningful to their learners.

- (v) *Division of labour [teacher factors]*: The same concepts in the first activity system also applied in the construct of the second activity system. Teacher factors (Rogan & Grayson, 2003) influenced the division of labour, since participants had certain expectations as to how they were going to implement a PoP (puppetry) and how they experienced it (see Chapter 5, §§ 5.3 and 5.5).
- (vi) *Object*: The object for these participants was that they had the opportunity to develop themselves “as learners” to transfer PoP (puppetry), writing scripts for puppets, mathematising them and becoming more metacognitively aware of what, why and how they engaged (and transferred their newly gained knowledge obtained in the intervention to their own teaching-learning praxis) (see Chapter 5, §§ 5.3; 5.5 and 5.7).

For the sake of the reader, activity system two is based on secondary research questions four and five.

The contradiction of control that existed between the intended object of each of these activity systems allowed for certain tensions to arise. According to Yamagata-Lynch (2010), tensions (positive and negative) arise when the subject of an activity system is put in a contradictory position where the object precludes them and they fail to achieve it. These tensions are discussed in detail in Chapter 6 (Table 6.2).

Third-generation CHAT provides a powerful lens, which was employed in this research; however, I decided to integrate it with the Rogan and Grayson model which refers to curriculum implementation. Although curriculum implementation is a much larger concept, I decided to apply the constructs of the Rogan and Grayson model as they focus largely on the influence of context when implementing something new (PoP [puppetry] as new teaching-learning strategy in the intermediate phase mathematics classroom). Since the schools in this study were located in rural and township areas, the context of these schools served as points of departure, which had to be described and better understood.

3.2.2.2 Rogan and Grayson model

According to the Rogan and Grayson (2003) model, for curriculum implementation to occur, certain constructs need to be adhered to: (i) profile of implementation; (ii) capacity to support innovation; and (iii) support from outside agencies. These constructs are discussed briefly and linked to this research.

- (i) *Profile of implementation:* For implementation to occur, the notion of “good practice” needs to be defined pertaining to the classroom environment. This construct allows for good teaching-learning praxis regarding the content to be modelled, leading to different pedagogies (tools like a PoP – puppetry [Engeström, 1987]) teachers may integrate. By defining “good practice”, teachers can determine their own strengths and weaknesses, which enhances their metacognitive awareness. Teachers are then able to consider the context and capacity of a school and select the most appropriate tools (Engeström, 1987) they would like to apply for meaningful implementation (teaching-learning) of CAPS (DoE, 2011) to occur (Rogan & Grayson, 2003). In this research, I argue that PoP (puppetry) is one route with which intermediate phase mathematics can be presented so that meaningful learning and implementation of the curriculum can occur.

- (ii) *Capacity to support innovation:* The implementation of new ideas is often hindered when implemented in a school system. Due to context, not all schools can (or have the capacity) to implement innovative ideas and tools to the same extent (Rogan & Grayson, 2003). In this research, I argue that PoP (puppetry) is an innovative idea that any school in any given context can implement to the same extent *if* the context serves to contextualise and mathematise the mathematics that teachers prepare. The context of the school becomes the vantage point from which the learning stems, creating a space for adequate connection between mathematics content and learners’ real-life experiences in the surrounding school community. Innovation usually takes place when teachers are put in the position where new approaches need to be implemented (in this study, during and after the intervention) (Engeström, 1987; Rogan & Grayson, 2003). In this research, the implementation of adapted lesson study supported this notion as teachers proceeded with lesson planning of existing topics in CAPS (DoE, 2011) which still had to be taught and infused with their puppet scripts. Nothing about the lesson planning process was new to them, except writing scripts and infusing the scripts with a PoP (puppetry) while engaging collaboratively with the other participants.

- (iii) *Support from outside agencies:* Support from outside agencies can also contribute to the implementation of innovative strategies like PoP (puppetry). In this research, my involvement in a project on indigenous knowledge (sponsored by the National Research Foundation [NRF] and the FUCHS Foundation) allowed me to provide each participant with their own puppet. These puppets were handcrafted by women in Jan Kempdorp as part of upliftment, empowerment and community engagement. Puppets were also afforded to other schools in other provinces in need of such resources – those teachers (although not part of my research, but the bigger project instead) were afforded the

opportunity to train in PoP (puppetry) similar to my study. Acknowledgement - I hereby acknowledge the National Research Foundation (NRF) and the FUCHS Foundation. Views expressed are not necessarily that of the NRF or FUCHS Foundation.

I integrated these constructs as principles (points of departure) when I designed the material for the intervention. The Rogan and Grayson (2003) model also makes use of indicators that characterise these constructs and, in essence, the model. The indicators are: (i) physical resources; (ii) teacher factors; (iii) learner factors; and (iv) school ecology and management, which influence each of the constructs respectively. In this research, I only focused on the following indicators: physical resources; teacher factors; and learner factors. Although school ecology and management also contribute to context, the focus thereof is more on management of the school itself, which was not part of the aim of this study. With the integration of third-generation CHAT and the Rogan and Grayson model, the following indicators may arise after the intervention as tensions when participants implement PoP (puppetry) in their respective classrooms.

- (i) *Physical resources [tools]*: According to Rogan and Grayson (2003), poor resources and conditions can place limitations on the performance of even the best teachers. These are cause for learners' performance to be undermined and reduce their efforts to focus on learning. In this research, the different contexts of the participating schools varied. Therefore, physical resources were provided and given to participants, allowing them to be on the same "level" with regard to their participation in the intervention.
- (ii) *Teacher factors [subject; division of labour]*: Background, level of training and confidence are factors influencing teachers' commitment to teaching-learning (Rogan & Grayson, 2003). The lack of PCK is a problem in South Africa (Venkat & Spaul, 2015). When teachers' PCK is enhanced with innovative teaching-learning pedagogies (puppetry), a more successful classroom practice is fostered (Kultsum, 2017). By applying innovative tools like PoP (puppetry), change is brought about in the intermediate phase mathematics classroom, challenging teachers to try out innovative ideas where they improvise (Rogan & Grayson, 2003). Although participants (subjects) (Engeström, 1987) were exposed to uncertainty, the learning process in which they engaged with a PoP (puppetry) allowed them to be agents of change in the intermediate phase mathematics classroom by implementing (division of labour) (Engeström, 1987) it in their respective intermediate phase mathematics classrooms.

- (iii) *Learner factors:* As soon as teachers plan lessons, learners' background needs to be considered together with the context of the school. Thought must be given to learners' strengths, weaknesses and what they may bring to the learning situation. According to Rogan and Grayson (2003), in South Africa, the language of instruction may sometimes be learners' second or third language, creating a learning barrier due to the lack of language proficiency on the learners' part. I argue that PoP (puppetry) creates a space for learners to hone their language skills because they engage with the puppet (as a "person/peer"), not feeling anxious about their language proficiency as puppets are not "judgemental" of language and/or ideas.

These indicators defined each of the constructs and afforded the participants the opportunity to reconceptualise a changed (innovative) teaching-learning praxis on their own terms (infused with support material and guidelines from the intervention) in their own school contexts (Engeström, 1987; Rogan & Grayson, 2003).

Social constructivism as theoretical framework together with third-generation CHAT and the Rogan and Grayson (2003) model as theoretical lenses provided the opportunity to interpret participants' experiences and challenges (relevant to the context and surrounding culture in which the schools were immersed) with regard to teaching intermediate phase mathematics with a PoP (puppetry).

The interpretation of these descriptions was based on the participants' implementation of puppetry in their classrooms and how the script they wrote during workshop two reflected on learners' real-life experiences. The way in which these teachers mathematised the lesson, how they implemented metacognitive awareness, and how they reflected on the presented lesson broadened my understanding of these experiences, challenges and role of context.

3.2.2.3 Integration of third-generation CHAT and the Rogan and Grayson model

The integration of these two research lenses led to the authentic synthesis thereof (see Table 3.4), which is applied to this study.

Table 3.4: Synthesis of third-generation CHAT and the Rogan and Grayson model

Rogan and Grayson Model	Third-generation CHAT activity systems (1 - Intervention) and (2 – Participant experiences)					
	a) Tools	b) Subject	c) Rules	d) Community	e) Division of labour	f) Object
Profile of implementation	* PoP (puppetry)	* Int. phase mathematics and foun. phase teachers	* CAPS (DoE, 2011)	* Principal	* Participant as reflective practitioner modelling “Good” teaching-learning praxis	* Enhanced metacognitive awareness; * Improved teaching-learning through a PoP with puppets
Capacity to support innovation	* Intervention * Metacognitive awareness		* Tenets of school mathematics * Lesson planning * Guidelines for puppetry * Guidelines for writing puppetry scripts	* Facilitators * Learners * Peer teachers as participants and collaborators * Principal		
Support from outside agencies	Indirectly, as part of my involvement in a project on Indigenous Knowledge sponsored by: * FUCHS Foundation * National Research Foundation (NRF)					
Physical resources	* Lesson plans * Puppetry scripts * Puppets		* Pace setters * CAPS (DoE, 2011)	* Participating teacher colleagues * Principals * Parents * Surrounding school community (context)		
Teacher factors	* Metacognitive awareness strategies * Participants’ PCK	* Int. phase mathematics-and foun. phase teachers transferring PoP (puppetry)	* Lesson planning * Tenets of school mathematics		* Reflective practitioner * Facilitator of teaching-learning; * Agent of change	* Transferring PoP (puppetry) while being metacognitively aware of planning, monitoring, evaluating and reflecting for, in and on teaching-learning
Learner factors	* Learners using puppets themselves to engage in teaching-learning (Ahlcrona, 2012)	* Teachers mathematising and contextualising mathematics (Koustourakis; Zacharos, 2011	* Learners adhering to classroom rules or the puppets’ “rules” for “surfacing” in the classroom (Korošec, 2012)	* Learners in respective schools and int. phase mathematics classrooms	* Learners as reflective practitioners (Keogh et al., 2008)	
Key: Int. phase (intermediate phase); foun. phase (foundation phase); purple colour (Third-generation CHAT activity system 1 – the intervention); green colour (Third-generation CHAT activity system 2 – participant experiences); blue colour (suggestions pertaining to learner factors).						

(adapted from Engestrom,1987; Rogan & Grayson, 2003)

In Table 3.4, the first three constructs (1–3) of the Rogan and Grayson model align with the third-generation CHAT concepts of the first activity system (intervention). The last three indicators (4–6) of the Rogan and Grayson model align with the third-generation CHAT concepts of the second activity system (participant experiences) after the intervention. This synthesis served as the guideline for data analysis and reporting, since it provided a holistic approach, describing participants' overall experiences during the intervention and their individual experiences after the intervention in their respective intermediate phase mathematics classrooms. The only additional contributions in Table 3.4 can be seen in indicator 6 (learner factors – in blue) of the Rogan and Grayson model. These suggestions were not added to the third-generation CHAT (Figure 3.2) as the focus of this study was on the teachers as participants and their experiences (directly) as opposed to the learners who are involved in a more indirect manner. These suggestions were made based on the literature review.

3.3 Research approach

A qualitative research approach is suited for research where the variables are unknown and there is a need to explain (Creswell, 2014). The need to explain is underpinned by data collection in order to learn more from the participants in the study. Data collection in qualitative studies is usually emerging as researchers put themselves in the shoes of their participants (Creswell, 2014). The generic qualitative research approach was infused with elements of phenomenology due to the nature of the research questions and coursework required to generate data (which can be attributed to my varied experiences in rural and township schools during the acquiring of my teaching degree and honours degree in mathematics education). The research design and methodology employed in this study are subsequently discussed.

3.3.1 Research design and methodology

According to Creswell (2014), a research design encompasses specific procedures necessary to complete a research process namely: data collection, data analysis, and the interpretation of results. To address the primary and secondary research questions, this generic qualitative study was based on elements of phenomenology. In order to understand why certain elements of phenomenology were employed, phenomenology is discussed next.

3.3.2 Phenomenology

Phenomenology is based on the work of the philosopher Edmund Husserl (Centre for Innovation in Research [CIRT], 2014; Groenewald, 2004). Phenomenology is a tool for describing human experiences; how humans experience the phenomenon (in this case, PoP

[puppetry] and metacognitive awareness), allowing the researcher to delve into their perceptions, perspectives, understandings and feelings (CIRT, 2014). One phenomenological element in this study was reflective journals, which participant teachers had to write, assisting them to reflect on their teaching-learning experiences with a PoP (puppetry) after they had presented their planned lessons to their respective intermediate phase mathematics classrooms. The phenomenon identified when analysing the reflective journals were embedded in the primary research question stating:

- *What are intermediate phase mathematics teachers' lived experiences based on the transfer of a PoP (puppetry) and the development of their metacognitive awareness in the mathematics classroom, as scaffolded by an intervention to enhance SDL*

Phenomenology is open-ended by nature, and reflective journals provided the researcher with the opportunity to extract details of participant teachers' experiences of PoP (puppetry) and metacognition (metacognitive knowledge and metacognitive awareness) for data generation purposes (CIRT, 2014). According to CIRT (2014), Creswell (2014), Groenewald (2004) and Padilla-Diaz (2015), a phenomenological study (or elements thereof infused with generic qualitative studies) involves four steps to collect, analyse and discuss the data. These steps were applied to the reflective journals.

Table 3.5: The four steps of a phenomenological research design

Steps	Description – As the researcher, I...
(i) Bracketing	had to describe pre-conceived beliefs, opinions or notions about the phenomenon (PoP – puppetry and metacognitive awareness) to prevent interference with the process of data analysis – <u>Participant perceptions before the intervention</u>
(ii) Intuition	became immersed in the study – Textual description of data allowed me to determine what participants were saying and experiencing – <u>Participant perceptions and experiences before and during the intervention</u>
(iii) Analysis	Descriptive data and coding were applied to categorise the data. The goal was to develop <i>a priori</i> codes based on the literature study, describing participants' experiences of teaching-learning with a PoP (puppetry) in the intermediate phase mathematics classroom – <u>Analysis of reflective journal data</u>
(iv) Description	Structural description allowed for reporting on textual descriptions the essence of the phenomenon (PoP – puppetry and metacognitive awareness) were identified and reported on – <u>Presentation of findings and preliminary results in Chapter 4</u>

(adapted from CIRT, 2014; Creswell, 2014; Groenewald, 2004; Padilla-Diaz, 2015)

Based on the definitions of phenomenology by CIRT (2014), Creswell (2014), Groenewald (2004) and Padilla-Diaz (2015), I decided to apply these steps to discuss the data obtained from the reflective journals as part of the overall study.

3.4 Research site and participants

This generic qualitative-phenomenological study was conducted in two rural and one township school in the North West province. According to Brown and Chu (2008), contextualisation differs due to environmental influences. At first, three schools in different areas (rural, township and urban) were to be purposefully selected, but the urban schools did not consent for participation in this study. The participating schools were selected purposefully based on my experiences at similar schools during my work-integrated learning experiences during my undergraduate studies.

This study was underpinned by a non-probability sampling method, which involves purposive sampling. Purposive sampling is done with a specific purpose (aim) in mind (Creswell, 2014). The aim in this study was to describe 10 intermediate phase participants' experiences before, during and after an intervention addressing metacognition (metacognitive awareness) and PoP (puppetry) in the mathematics classroom. The inclusion criteria based on purposive sampling in this study included:

The participants: (i) were from rural, township or urban schools; (ii) teaching in intermediate phase; (iii) teaching mathematics. Two intermediate phase (Grades 4 to 6) mathematics teachers at each of the three schools were invited to participate in this research. The principal allowed the invitation of this study to reach "back-up" teachers in the school, who occasionally assisted these intermediate phase mathematics teachers to teach this specific phase. The "backup" teachers had previous experience with teaching intermediate phase mathematics before they taught their phases at the time of this study (foundation phase – Grades R to 3; or senior phase – Grade 7 to 9). Therefore, 10 (N=10) teachers participated in the research). In Table 3.6, the biographical and demographic information of participants are represented. This group of participants was small in order to support rigorous data collection by means of the various instruments. The intervention with these teachers ensured active engagement. Active engagement ensures deeper reflection (improved responses) from participant teachers' teaching experiences (De Vos et al., 2015). The table provides information on the participants' teaching experience in mathematics; their teaching experience overall; the phases they taught; challenges they faced, like the number of learners in their classroom; multigrade teaching; school context; mother-tongue language; and medium of instruction.

Table 3.6: Biographical and demographic information of participants in this study

Participant	Participant 1 (P1)	Participant 2 (P2)	Participant 3 (P3)	Participant 4 (P4)	Participant 5 (P5)	Participant 6 (P6)	Participant 7 (P7)	Participant 8 (P8)	Participant 9 (P9)	Participant 10 (P10)
Gender	Female	Female	Male	Female	Male	Female	Female	Female	Male	Female
Age	30–39 years	40–49 years	20–29 years	50 years and older	50 years and older	50 years and older	50 years and older	30–39 years	20–29 years	30–39 years
Teaching experience in mathematics (in years)	6–8 years	More than 15 years	3–5 years	More than 15 years	More than 15 years	6–8 years	More than 15 years	6–8 years	3–5 years	9–11 years
Teaching experience total (in years)	9–11 years	More than 15 years	3–5 years	More than 15 years	More than 15 years	More than 15 years	More than 15 years	6–8 years	3–5 years	9–11 years
Average number of learners in your mathematics classroom	Less than 24 learners	Less than 24 learners	30–35 learners	More than 40 learners	More than 40 learners	More than 40 learners	More than 40 learners	More than 40 learners	More than 40 learners	More than 40 learners
Multigrade teaching (two Grades in one classroom at the same time)	No	No	Yes (Grade 6 & 7)	Yes (Grade 6 & 7)	No	No	No	No	No	No
Area (context) of school	Rural	Rural	Rural	Rural	Township	Township	Township	Township	Township	Township
Teaching phase(s)	F. phase	F. phase	Int. phase	F. phase; int. phase & sen. phase	Sen. phase	Int. phase	Int. phase	Int. phase	Int. phase	Int. phase
Mother tongue	Afrikaans	English	Tswana	Tswana	Afrikaans	Afrikaans	Afrikaans	Afrikaans	Afrikaans	Afrikaans
Medium (language) of instruction	English	English	English	English & Tswana	English and Afrikaans	Afrikaans	English and Afrikaans	English	English	Afrikaans

* F. phase (foundation phase – Grades R to 3); int. phase (intermediate phase – Grades 4 to 6); sen. phase (senior phase – Grades 7 to 9).

3.4.1 Overview of the 10 participants involved in this study

The 10 participants involved in this study were the subjects (according to third-generation CHAT research lens employed in this study) whose profile to implement PoP looked as follows.

3.4.1.1 Participant 1 [P1*]

Participant 1 (female, 30–39 yrs. age range) had between nine and 11 years of teaching experience in total, of which six to eight years were spent teaching mathematics. She was a teacher at a rural school and had less than 24 learners in her classroom. She taught foundation phase, but due to the dynamic nature of this school, she also assisted in teaching intermediate phase mathematics when she needed to do so. She did not teach in her mother tongue (Afrikaans) but in the school's medium (language) of instruction (English).

3.4.1.2 Participant 2 [P2*]

Participant 2 (female, 40–49 yrs. age range) had more than 15 years of teaching experience in total, of which all were spent teaching mathematics. She also was a teacher at a rural school, teaching less than 24 learners in her classroom. Although she, too, taught foundation phase, her school also required her to assist with intermediate phase mathematics. She taught in her mother tongue (English), which was also the medium (language) of instruction at her school.

3.4.1.3 Participant 3 [P3*]

Participant 3 (male, 20–29 yrs. age range) had between three and five years of overall teaching experience, of which all was spent teaching mathematics. He was a teacher at a rural school and his classroom accommodated between 30 and 35 learners. He taught intermediate- and senior phase mathematics. He also taught multigrade classes (more than one Grade group per class) – Grade 6 and 7 specifically – and did not teach in his mother tongue (Tswana). The school at which he taught had English as medium (language of instruction).

3.4.1.4 Participant 4 [P4*]

Participant 4 (female, 50 yrs. and older age range) had more than 15 years of teaching experience, of which all were spent teaching mathematics. She taught more than 40 learners in her classroom. She taught at a rural school and also taught multigrade classes (Grade 6 and 7). She taught foundation phase, intermediate phase and senior phase mathematics and various other school subjects. Her mother tongue was also Tswana, but her school's medium (language) of instruction required her to teach in English (and Tswana in her language subject-orientated periods).

3.4.1.5 Participant 5 [P5*]

Participant 5 (male, 50 yrs. and older age range) had more than 15 years of teaching experience, of which all were spent teaching mathematics. He taught more than 40 learners and was situated in a township school. He taught the senior phase but was also the head of department of mathematics at his school, therefore overseeing the intermediate phase teachers and supporting them in their teaching-learning endeavours. His mother tongue was Afrikaans and his school's mediums (language) of instruction were English and Afrikaans.

3.4.1.6 Participant 6 [P6*]

Participant 6 (female, 50 yrs. and older age range) had more than 15 years of teaching experience, of which six to eight years were spent teaching mathematics. She taught more than 40 learners and was also situated in a township school. She taught the intermediate phase. Her mother tongue was Afrikaans, and although her school's mediums (language) of instruction were both English and Afrikaans, she only taught in Afrikaans.

3.4.1.7 Participant 7 [P7*]

Participant 7 (female, 50 yrs. and older age range) had more than 15 years of teaching experience, of which all were spent teaching mathematics. She also taught more than 40 learners and was situated in a township school. She taught the intermediate phase. Her mother tongue was Afrikaans and her school's mediums (language) of instruction were both English and Afrikaans.

3.4.1.8 Participant 8 [P8*]

Participant 8 (female, 30 to 39 yrs. age range) had between six and eight years of overall teaching experience, of which all were spent teaching mathematics. She taught more than 40 learners in her classroom and was also situated in a township school. She taught the intermediate phase. Her mother tongue was Afrikaans and although her school's mediums (language) of instruction were both English and Afrikaans, she only taught in English.

3.4.1.9 Participant 9 [P9*]

Participant 9 (male, 20 to 29 yrs. age range) had between three and five years of overall teaching experience, of which all were spent teaching mathematics. He taught more than 40 learners and he was situated in a township school. He taught the intermediate phase. His mother tongue was Afrikaans, and although his school's mediums (language) of instruction were both English and Afrikaans, he only taught in English.

3.4.1.10 Participant 10 [P10*]

Participant 10 (female, 30 to 39 yrs. age range) had between nine and 11 years of overall teaching experience, of which all were spent teaching mathematics. She taught more than 40 learners in her classroom and was also situated at a township school. Her mother tongue was Afrikaans, and although her school's mediums (language) of instruction were both English and Afrikaans, she only taught in Afrikaans.

3.5 Data generation strategies

Data generation strategies included:

- (i) Semi-structured open-ended individual interviews before workshop one (Annexure I);
- (ii) Reflective prompts (Annexure F);
- (iii) Observations during both workshops (Annexure J);
- (iv) A focus group interview after the second workshop (Annexure L); and
- (v) Reflective journals submitted two to three weeks after the intervention (Annexure M).

During the data generation before, during and after the intervention, not all participants attended due to personal matters that surfaced. It was important for participants to attend workshop one where the theoretical foundations of metacognition and PoP (puppetry) were established before they could collaborate and engage in the work session (adapted lesson study and writing of puppetry scripts) during workshop two. Seven participants (N=7) attended workshop one. The other three participants (N=3) who were absent from the first workshop agreed upon separate week days the following week in which I presented the first workshop to them, orientating them with regard to what had happened during this workshop the previous Saturday. Nine participants (N=9) attended workshop two. The sole participant whom was absent from this second workshop, did not arrange a "catch-up" session in which he could engage in adapted lesson planning and puppetry script writing. It was decided that, due to his rigorous investment into the role he fulfilled at his school (mathematics head of department) and time constraints associated with such a position, the data he provided before and during workshop one were to be integrated into this study and that it was not necessary for him to submit a reflective journal.

3.5.1 Semi-structured open-ended individual interviews

Individual interviews require that participants respond predetermined semi-structured open-ended questions, but that enough time is allocated for deeper reflection before responses are

given (Nieuwenhuis, 2010). Semi-structured open-ended questions were developed from questions from the Metacognitive Awareness Inventory of Teachers (MAIT) Questionnaire (Balcikanli, 2011). The questions for this interview can be seen in Annexure I. In this study, all participants (N=10) were interviewed.

3.5.2 Reflective prompts

The integration of third-generation CHAT as theory requires reflection (Engeström, 2001). Since reflection is the cornerstone of metacognition, it is a means by which participants had the opportunity to reflect on their own teaching-learning praxis and experiment with the knowledge they had gained during the intervention in their respective classrooms. According to Creswell and Clark (2017), a theory in educational research allows for participants to give explanations of their additional knowledge in their field of expertise (intermediate phase mathematics). The prompts (see Annexure F) allowed for thorough reflection by participants on the topic (PoP – puppetry and metacognitive awareness) (refer to Table 2.5). These reflective prompts focused on the importance of what was learned during that particular presentation; unanswered questions the participant would have liked more clarity on; the advantages and/or disadvantages of the topic in an intermediate phase mathematics classroom; perceptions on the applicability of the topic in question; and how participants' learners reacted towards it as well as a summary of what was learned during each presentation. During workshop one, seven participants (N=7) attended and all of them completed their reflections (reflective prompts) based on this workshop. During workshop two, nine participants were present, but seven (N=7) completed their reflections (reflective prompts) based on this workshop.

3.5.3 Observations

I observed participant teachers by being an active participant-observer during the intervention. A participating-observer refers to someone who becomes a participant in the situation that is observed (Maree, 2016). Observations with field notes allowed me to gain insight into the participants' dynamics (such as how they engaged with the material on PoP [puppetry] as well as metacognitive awareness of how they planned and presented lessons and how they reflected on these experiences) (Maree, 2016). A situation analysis (Annexure K) was made before participant teachers engaged in lesson planning and the writing of puppetry scripts. A structured observation schedule accompanied the observations (see Annexure J). The observation schedule yielded additional field notes for me to analyse and strengthen the data obtained from the interviews and reflective journals. The observations allowed for data to surface on how intermediate phase mathematics teachers prepared lessons, infused puppetry and wrote puppetry scripts during the intervention based on the support and guideline materials received during the intervention. During

workshop one, seven participants were present (N=7) and were observed during this workshop. During workshop two, nine participants (N=9) were present and were observed during this workshop.

3.5.4 Focus group interview

Focus group interviews gives a shared understanding (in this case, experiences after an intervention on metacognition and PoP [puppetry]) of several individuals (Creswell, 2014). Due to the collaborative nature of this intervention, a focus group interview was conducted with participants directly after workshop two. Participants were not hesitant to share their insights and experiences of the intervention, and they all took turns in talking and contributing to the richness of the data obtained from this interview. According to Krueger and Casey (2014), focus group interviews are beneficial to understanding a range of opinions on a specific phenomenon (experience). The questions of this interview can be seen in Annexure L. After workshop two, of the nine participants present, two had to leave before the focus group interview due to personal responsibilities; therefore seven (N=7) participated in the focus group interview.

3.5.5 Reflective journals

According to Bashan and Holsblat (2017), reflective journaling is key to establish stages of development undergone by participants. Reflective journals are an important part in the documentation of the process undergone by participants on growth in their teaching-learning praxis (Bashan & Holsblat, 2017). Reflective journals in this research provided participants with the opportunity to voice their experiences with a PoP (puppetry) (O'Connell & Dymont, 2011). As established in the literature (see Table 2.4), one of the main components in metacognition is reflection. The reflective journals allowed participants to integrate metacognitive awareness strategies (providing me with insight into their thought processes), like the journaling of their experiences in their respective mathematics classrooms. According to Silvia, Valerio, and Lorenzo (2013), this (reflective journals) is a point of departure where participants identify their challenges, how they may address these challenges in the future, and how this teaching-learning experience would find a way to return in the participants' repertoire (PCK) for future teaching-learning endeavours. The reflective journal template, which allowed participants to capture their experiences, can be seen in Annexure M. The journals provided insight into their teaching-learning philosophy; expectations of teaching with puppetry; what they had learned regarding teaching mathematics with puppetry; their reflection on the lesson they had taught; how they were going to improve on future endeavours; learners' reaction towards the puppets; surprises that occurred during the lesson; struggles (frustrations) they endured; and overall planning and presentation. Metacognitive thought processes (awareness) emerged with the analysis of these

reflective journals, and a summary of all the findings were made. Of the 10 participants in this study, seven (N=7) participants completed and submitted their reflective journals.

In the four phases of this research, the data were generated and unfolded as follows:

3.5.5.1 Unfolding phase 1: Perceptions prior to workshop one and two of the intervention

This phase is linked to secondary research questions one and two, relating to participant perceptions of PoP [puppetry] and metacognition before and during the intervention (see Table 3.1). Semi-structured open-ended individual interviews were conducted with each participant before the intervention. All participants were eager to participate in these interviews. The questions of this interview were provided to participants a week before the interviews took place. Semi-structured open-ended individual interviews were conducted before phase one prior to the intervention. These interviews were recorded by means of a cell phone recorder application, enabling me to make valid assumptions about the findings. I transcribed these interviews verbatim. To ensure validity, face validity was employed after the interviews. An interview schedule assisted to keep record of the interviews, which ensured validity. These interviews were fundamental to this study, since it hinged on reflection, activating essential thought processes for participants to reflect deeply on their teaching-learning praxis with regard to the planning, monitoring and reflection before, during and after their own teaching-learning in their respective intermediate phase - and foundation phase mathematics classes, as well as on the intervention and the application and value of PoP (puppetry) in the intermediate phase mathematics classroom.

3.5.5.2 Unfolding phase 2: Workshop one as orientation workshop

This phase is linked to secondary research questions one and two, relating to participant perceptions of PoP [puppetry] and metacognition before and during the intervention (see Table 3.1). Workshop one was conducted on the first Saturday of the intervention. The workshops were held consecutively on request of the participants. Both workshops were half a day. Participants were introduced to cost-effective strategies for teaching-learning in mathematics included in the TMSK®, which included boomwhackers to teach fractions (via music) and Morabaraba as indigenous game to teach two-dimensional geometry concepts. An introduction to PoP (puppetry) and metacognitive awareness was presented to participants (see PowerPoint presentations in Annexures G [PoP – puppetry] and H [metacognition]) on which they reflected after each presentation by means of reflective prompts in their intervention booklet. These reflective prompts were selected to guide the participants in their reflective processes and to introduce them to thorough reflective methods they had to employ in the writing of their reflective journals in phase

four. Participants also chose their puppets they deemed to be appropriate to teach with as part of this study and for future teaching-learning endeavours.

3.5.5.3 Unfolding phase 3: Workshop two as adapted lesson study and script writing workshop

This phase is linked to secondary research question three, relating to how participants prepare lessons and integrate puppetry scripts before and during the intervention (see Table 3.1). During workshop two, adapted lesson planning and script writing for the puppets took place. Participants also had the opportunity to share their experiences when introducing their puppets to their respective mathematics classrooms. Participants engaged in role play where they enacted scripts that were adapted from true indigenous South African tales. One script was mathematised (infused with mathematics principles). By enacting stories and a mathematised lesson, participants could see the difference in storytelling and mathematisation of scripts. The participants received information in the intervention booklets, which was discussed. Participants brought textbooks, the CAPS (DoE, 2011) document and existing mathematics lesson plan templates with for this session. After theory on script writing had been dealt with, participants infused these existing lesson plans by writing scripts for their puppets and mathematising them so that they could teach the content in the following two weeks. The facilitators assisted the participants in script writing and lesson planning and streamlining the overall process. Due to unforeseen circumstances, one participant was unable to participate in this workshop (N=9). The participants engaged in a post-focus group interview. Due to familial and other commitments, two of the nine participants had to leave early; therefore, data for this phase were obtained from N=7 participants.

3.5.5.4 Unfolding phase 4: Submission of reflective journals

This phase is linked to secondary research questions four and five, relating to participant experiences with a PoP [puppetry] and metacognition (and transfer thereof) after the intervention (see Table 3.1). Reflective journals had to be submitted within two weeks' time after the last workshop of the intervention. These reflective journals were compiled and given to participants in the form of a template, which they had to complete in either hard- or soft copy and submit to me on a given date. The reflective questions were selected in such a manner that participants' experiences and the transfer of knowledge from the intervention to their respective intermediate phase mathematics classrooms were captured in their answering of these questions.

3.6 Data analysis strategies

According to Creswell (2014), data should be thoroughly organised for the data process to be rigorous and informing with regard to the nature of the study. The data were organised according

to each of the four phases (as discussed in this chapter) in order for rigorous data analysis to commence. Data analysis in this study occurred by means of the integration of the two lenses from the theoretical framework. Vertical analysis refers to participants' personal contributions towards the data based on the schools and contexts in which they are immersed, influencing their perceptions and experiences. Horizontal analysis occurred when all participants' experiences were analysed to establish what enhanced, limited or clashed in regard to their metacognition (metacognitive awareness) and PoP (puppetry). Pure hermeneutical data analysis and narrative analysis were employed in this study. The former method of analysis, as proposed by Nieuwenhuis (2016), was used to analyse the reflective journals, and the latter, as proposed by Creswell (2014), was used to analyse the semi-structured open-ended individual interviews, reflective prompts, observations, and the focus group interview.

According to Cohen, Manion, and Morrison (2017), pure hermeneutics seeks to understand the situations that participants experience (through their eyes) complementing social constructivism's view that reality is something that is socially constructed. Hermeneutics allows for meanings (experiences) of participants to be captured (Cohen et al., 2017).

Narrative analysis entails the study of the lived experiences by participants in written form (told through their own stories) (Creswell, 2014). Narrative analysis was employed to analyse the interviews, reflections and observations.

The data obtained from the interviews, reflective prompts, observations and reflective journals were combined with my own (the researcher's) views to ensure coherence, strengthening the voice of participants' lived experiences with a PoP (puppetry) and metacognition (metacognitive awareness), enhancing their self-directedness (Creswell, 2014).

The following section describes my role as researcher throughout this study.

3.7 Role as researcher

According to Simon (2011), researchers' involvement in qualitative studies is considered as being *instrumental* (relating to experiences) – therefore, data are mediated through a *human instrument* rather than through inventories, questionnaires, or machines. My role as researcher throughout this study was to recognise participants' values and personal interest in the research process. Table 3.7 provides an overview of themes that can be linked to my role as researcher and that emerged during this study. The themes were adapted from Patton (1990) and Van der Walt (2006).

Table 3.7: Interconnectedness of themes and my role as researcher

Theme	My role as researcher
Naturalistic investigation	The research was conducted at a university (on participants' request), making it convenient for participants.
Holistic perspective	Metacognition entails a holistic perspective and allowed me to explore participants' views, ideas, beliefs, transfer and overall experiences of metacognition and a PoP (puppetry) in the intermediate phase mathematics classroom.
Qualitative data (interviewer)	Detailed explanations were gathered by conducting semi-structured open-ended individual interviews (verbatim transcriptions), reflection (reflective prompts), observations with field notes, a focus group interview, and reflective journals before, during and after this intervention.
Personal contact with participants	I communicated and arranged all of the details before, during and after the intervention with participants, allowing for clear communication lines, putting them at ease.
Dynamic systems (the phenomenon is dynamic and emerging and can change throughout the study)	Participants' experiences differed from each other in the intermediate phase. Participants' school context (and environment) allowed them to implement (and experience) metacognitive strategies and PoP (puppetry) differently.
Sensitivity of contexts	The context relating to participants' environments (rural or township schools), the writing of puppetry scripts (mathematising content) and their application of PoP (puppetry) in their classrooms were context-bound and differed.

Table 3.7 depicts the seven themes and roles that emerged during each phase (see §§ 3.5.5.1–3.5.5.4) of this study. In the following section, my role as researcher in each phase is discussed.

3.7.1 Phase 1

Participant observer; interviewer: As observer and interviewer during the semi-structured open-ended individual interviews, I explored possible patterns and behaviours of each participant to gain a better understanding of the context in which he or she was immersed (Nieuwenhuis, 2010).

3.7.2 Phase 2

Holistic perspective; participant observer: Orientation (theoretical foundation) towards what metacognition and PoP (puppetry) is allowed for a holistic perspective to emerge, seeing that participants became aware of what they knew, did not yet know and had to find out (referring to metacognition and PoP [puppetry]). I fulfilled an observational role, observing participants' interactions with one another and with the content (presentations) (Nieuwenhuis, 2016).

3.7.3 Phase 3

Holistic perspective; participant observer; sensitivity of contexts: Participants had the opportunity to be part of an adapted lesson study approach, where they collaboratively worked together in planning of lessons and writing scripts for their puppets. These scripts and mathematising of content were context-bound, since participant approaches differed based on the location of the school and its learners (rural/township). I was an observer, observing how participants engaged in the lesson-planning process and how they wrote the scripts for their puppets. I also functioned as an interviewer, as part of the qualitative data generation process, in the focus group interview with participants.

3.7.4 Phase 4

Holistic perspective; dynamic system: In this phase, it became clear how participants transferred the knowledge that they had gained throughout the intervention to their respective intermediate phase mathematics classrooms. Various strategies were employed to teach with a PoP (puppetry) but varied between participants.

The next section elaborates on validity and trustworthiness in this study.

3.8 Validity and trustworthiness

Validity and trustworthiness refer to data generation, data analysis, results and findings that are reliable and auditable (Gunawan, 2015). Validity and trustworthiness are subsequently discussed.

3.8.1 Validity

In this study, I checked the accuracy of the findings by employing triangulation, member checking and external auditing (Creswell, 2014). Exploring this study from an interpretivist perspective based on social constructivism, multiple realities emerged with regard to participants' different insights, contexts, referencing frameworks, experiences and awareness of their teaching-learning practice. Therefore, data on participants' different perspectives contributed to the process of triangulation where evidence in the form of interviews, reflection (reflective prompts) and observations (with field notes) led to the coherent justification of themes and codes (Creswell, 2014). Interviews were transcribed verbatim and the participants had to later determine their accuracy (Creswell, 2014). An external audit was conducted by an individual not familiar with this research, who provided an objective assessment thereof (Creswell, 2014).

According to Cohen et al. (2007), research should include five aspects of validity, namely:

- (i) *Descriptive validity* refers to the factual accuracy based on the reflective journals that were submitted and were applied to fill in the gaps of the findings that emerged from the interviews, reflection (reflective prompts) and observations.
- (ii) *Interpretive validity* refers to my ability to make correct interpretations of generated data (as described in § 3.7: my role as researcher).
- (iii) *Theoretical validity* refers to how the phenomenon (metacognition and PoP [puppetry]) was explored based on participants' experiences before, during and after the intervention.
- (iv) *General validity* refers to how I understood the context in which the data were collected in order to make valid interpretations about their teaching-learning situation.
- (v) *Evaluative validity* refers to how I evaluated the phenomenon (metacognition and PoP [puppetry]) so that findings could emerge.

These aspects ensured validity of findings and were combined with the following strategies to ensure trustworthiness.

3.8.2 Trustworthiness

According to Eldridge (2011), trustworthiness “is as good as the instruments employed to collect the data” (p. 340). I ensured trustworthiness based on four of the eight strategies proposed by McMillan and Schumacher (2014):

- (i) Constant comparative method: Due to the various qualitative data generation strategies employed in this study (five strategies), comparing the data from each for all participants allowed for themes and codes to emerge with regard to participants' experiences of metacognition and a PoP (puppetry) in their respective classrooms.
- (ii) Triangulation: The integration of multiple literature sources to confirm my findings obtained from five different data generation strategies assisted me in the triangulation process.
- (iii) Respondent language; verbatim accounts: I obtained exact statements from participants by asking them for clarification on transcripts of the interviews and field notes obtained from observations.
- (iv) Record data: Use of video cameras (to capture and enrich data obtained from my observations with field notes) as well as a cell phone recorder during pre- and post-interviews.

Negative or deviant cases: Due to various influences (personal and work-related) on participants' lives, throughout this study, it was my aim to accommodate them should they have fail to attend a workshop and to make sure they were up to date with the research process. In a few cases, not all of the participants provided all of the data, but they were involved as much as they could be and provided what they could.

Validity and trustworthiness of the data were integrated with ethics throughout this study. In the following section, the ethical considerations are discussed.

3.8.3 Ethical considerations

Ethics refers to what is right and wrong (Fraenkel et al., 2012). Ethical clearance for this study was granted by EduREC – the Educational Ethics Committee of the North-West University (Ethics number: NWU-00788-18-A2) (see Annexure B). After ethical clearance was granted, permission to conduct research in the JB Marks Municipal area was sought from the North West Department of Education (Annexure C). The principal of each school and participants were informed about the research process and their roles therein. After agreeing to participate, the principals (Annexure D) and participants (Annexure E) signed informed consent forms. The principals and participants were informed regarding the purpose of this study in order for them to understand the nature of the research and its impact (potential risks and benefits, privacy and confidentiality) on them as the contact details of the myself and my study supervisor (Creswell, 2004). Creswell (2004) suggests the following ethical guidelines which I implemented in this study.

3.8.4 Voluntary participation

Participants could withdraw from this study at any time and their participation was voluntary. They did not have to answer all of the questions during the semi-structured open-ended individual interviews or any other component of if they wished not to. As soon as participants withdrew from the study, any and all data collected from them were destroyed immediately. No participant withdrew from this study, although not all of the participants contributed to all five of the data generation strategies (see § 3.5).

3.8.5 Potential risks and benefits

Additional time constraints, struggling to compile reflective journals, and participants' feeling of being unsuccessful when reflecting on their overall experience were identified as potential risks in this study. Time management allowed me to utilise the minimum amount of time of participants. Participants agreed to have the intervention over the course of two consecutive Saturdays instead of a few consecutive afternoons after school. Presentations during each of the workshops were

kept as succinct as possible and clear communication channels between the participants, my study supervisor and I were managed. I provided each participant with a reflection framework when compiling their reflective journals that guided them through the process. None of these risks were reported or endured by any of the participants.

Participants were collaboratively involved, and I sought their support throughout each of the phases of this study.

3.8.6 Privacy and confidentiality

The following measures were put in place to ensure privacy and confidentiality. Prior to the intervention, the semi-structured open-ended individual interviews were conducted at the venue and time of participant teachers' choosing. The participants at each school (individually) and I were the only individuals present during each of the interviews. By establishing parameters like these, I created a "safe space" for participants to answer questions freely during their individual interviews.

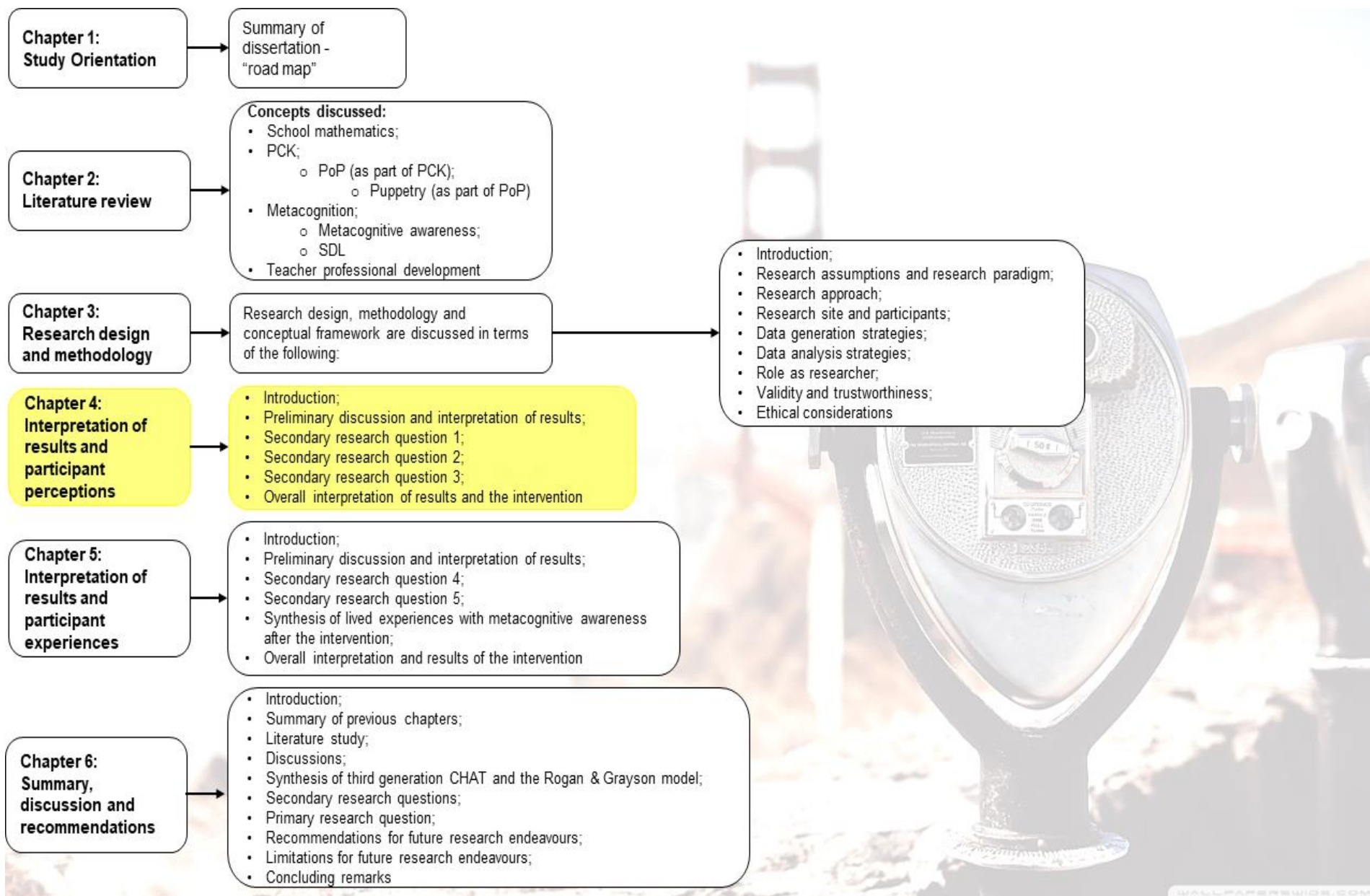
The results obtained for this research will not be utilised outside the parameters of this research. Anonymity was ensured by not naming the schools involved. The schools were not compared in any manner. Confidentiality was also ensured by organising the data systematically. Pseudonyms were used to identify each participant. Their names will thus not appear in any documentation.

On 31 December 2025 (seven years after the completion of the study in 2019) all data, including paper documents, will be destroyed by shredding them. Electronic files (e-mails and computer files) will be deleted. The researcher will store this data until this specified date in a safe (hard copies) and on a password-protected computer (soft copies).

3.9 Chapter summary

In this chapter, I discussed social constructivism as my research paradigm. This was a generic qualitative-phenomenological study and involved 10 intermediate phase and foundation phase ("back-up") mathematics teachers and the exploration of their experiences and transfer of PoP (puppetry) and metacognition (metacognitive awareness).

"Those who tell the stories rule society" (Plato).



CHAPTER 4: INTERPRETATION OF RESULTS AND PARTICIPANT PERCEPTIONS

4.1 Introduction

The integration of literature as well as the results from the three data collection instruments strengthened data triangulation as they allowed for coherent overarching themes, subthemes, categories and codes to emerge, contributing to the overall validity of this study (Creswell, 2014) to answer the research questions.

Perceptions (Chapter 4) concerning secondary research questions one to three and experiences (Chapter 5) concerning secondary research questions four to five of participants were grouped into four main, overarching themes, namely: (i) mathematics teaching-learning philosophy; (ii) metacognition; (iii) PoP; and (iv) intervention. Data of each overarching theme, subtheme and category were coded (see § 3.6) and the results interpreted against the background of the conceptual framework, strengthened by third-generation CHAT and Rogan and Grayson model as research lenses. This data analysis process was guided by the aim of the research, which is discussed next.

Table 4.1 presents the research questions that drove this study as well as the subsections in which the specific results were discussed in an attempt to answer that particular research question. The research questions were also showcased in terms of their interconnectedness in the five data collection instruments (Chapters 4 and 5 respectively). In Chapter 6, third-generation CHAT and the Rogan and Grayson model are integrated as research lenses to enhance our understanding of tensions that emerged in this study. The data were analysed by means of narrative analysis, as proposed by Creswell (2014). Narrative analysis was deemed to be appropriate as participants gave account of their own “stories”, sharing their perceptions and experiences before and during the intervention.

According to Trafford and Leshem (2010), for triangulation to apply to results, it is important that the research design adheres to the margins of the conceptual framework. In this study, the codes, categories, subthemes and overarching themes emerged from the literature study relating to mathematics teaching-learning; metacognition; PoP (puppetry); as well as the professional development of participants in the intervention. However, PCK overarches PoP (puppetry) and it was not part of the research questions itself and was not the focus of the data analysis process. It is important to note that PoP (puppetry) is nested in PCK. The data analysis was done according to the methodology described in Chapter 3.

4.1.1 Aim of the research

The aim of the data analysis was based on the primary research question. In Table 4.1, the research question and secondary research questions pertaining to this chapter, the interrelatedness with the data collection instruments, the subsections pertaining to the discussions thereof as well as the link between the sub-sections are presented.

Table 4.1: Research questions and interconnectedness of data collection instruments used in this study

Research question or secondary research questions	Chapter pertaining to research question or secondary research questions	Data collection instrument(s) pertaining to research question(s)	Subsection(s) in chapter pertaining to research question or secondary research questions	Link between subsection(s) and research question(s)
* Research question: What are intermediate phase mathematics teachers' lived experiences of an intervention based on pedagogies of play (puppetry) and metacognitive awareness to enhance Self-Directed Learning?	Overall in both chapters 4 and 5, answered in Chapter 6	(i) semi-structured open-ended individual interviews; (ii) reflective prompts; (iii) observations; (iv) post-focus group interview and; (v) reflective journals	4.3.1.1.4 4.4.1.1.3 4.5.1.1.4 5.2.1.1.4 5.3.1.1.4	Since all the secondary research questions aim to address the primary research question, all the subsections pertaining to each secondary research question (Column D) should be considered here, as listed already. Participants' lived experiences of the intervention specifically were captured (indicated in Column D), indicating participant growth along the ZPTD as suggested by Warford (2011).
* Secondary research question 1: What are intermediate phase mathematics teachers' perceptions of pedagogies of play (puppetry) before and during the intervention?	Chapter 4	(i) semi- structured open-ended individual interviews; (ii) reflective prompts; (iii) observations	4.3.1.1.3 4.4.1.1.2 4.5.1.1.3	Participants' perceptions of PoP were captured (§ 4.3.1.1.3) prior to the intervention and were further discussed as participants progressed through the intervention (§§ 4.4.1.1.2, & 4.5.1.1.3), allowing deeper insight into the progress with regard to their initial perceptions of PoP.
* Secondary research question 2: What are intermediate phase mathematics teachers' perceptions of metacognitive awareness before and during the intervention?	Chapter 4	(i) semi- structured open-ended individual interviews; (ii) reflective prompts; (iii) observations	4.3.1.1.2 4.4.1.1.1 4.5.1.1.2	Participants' perceptions of metacognition were captured (§ 4.3.1.1.2) prior to the intervention, which were further discussed as participants progressed through the intervention (§§ 4.4.1.1.1 & 4.5.1.1.2), allowing deeper insight into the progress in their initial perceptions of metacognition.
* Secondary research question 3: How do intermediate phase mathematics teachers prepare lesson plans and puppetry scripts to implement in their classrooms before and during the intervention?	Chapter 4	(i) semi- structured open-ended individual interviews; (ii) reflective prompts; (iii) observations;	4.3.1.1.1 4.5.1.1.1 4.5.1.1.3	Participants' mathematics teaching-learning philosophy was linked to their lesson planning and script writing (accounted for prior to the intervention – § 4.3.1.1.1), since it influenced the way in which they mathematised the script and infused it into the lesson (§§ 4.5.1.1.1 & 4.5.1.1.3)

Table 4.2 illustrates the a-priori codes, subthemes and overarching themes identified and integrated to analyse the data pertaining to the primary and secondary research questions as well as the conceptual framework.

Table 4.2: Interrelatedness of identified codes, categories, subthemes, overarching themes and research questions in this study

#	Research questions			Subthemes	Categories / a-priori codes	abbreviations
Mathematics teaching-learning philosophy						
1	<u>Secondary research question 3:</u> * How do intermediate phase mathematics teachers prepare lesson plans and puppetry scripts to implement in their classrooms before and during the intervention?	<u>Secondary research question 4:</u> What are intermediate phase mathematics teachers' lived experiences of the transfer of pedagogies of play (puppetry) after the intervention	<u>Secondary research question 5:</u> * What are intermediate phase mathematics teachers' lived experiences of the transfer of metacognitive awareness after the intervention?	Teaching mathematics	Multigrade teaching	MgT
					School and community context	Ctx
					Curriculum Assessment Policy Statement	CAPS
				Learning mathematics	Learners' learning	LL
					Learners' context (background)	LCTX
Metacognition						
2	<u>Secondary research question 2:</u> * What are intermediate phase mathematics teachers' perceptions of metacognitive awareness before and during the intervention?	<u>Secondary research question 5:</u> * What are intermediate phase mathematics teachers' lived experiences of the transfer of metacognitive awareness after the intervention?	Metacognitive knowledge	Person	MkP	
				Task	MkT	
				Strategy	MkS	
			Metacognitive awareness	Planning	MaP	
				Monitoring	MaM	
				Evaluating	MaE	
			Experiences	Lived experiences before	LEB	
				Lived experiences during	LED	
				Lived experiences after	LEA	
				Transfer during	TRD	
			Transfer after	TRA		
Pedagogy of Play						
3	<u>Secondary research question 1:</u> * What are intermediate phase mathematics teachers' perceptions of pedagogies of play (puppetry) before and during the intervention?	<u>Secondary research question 3:</u> * How do intermediate phase mathematics teachers prepare lesson plans and puppetry scripts to implement in their classrooms before and during the intervention?	<u>Secondary research question 4:</u> What are intermediate phase mathematics teachers' lived experiences of the transfer of pedagogies of play (puppetry) after the intervention?	Puppetry	Perceptions before	PB
					Perceptions during	PD
					Perceptions after	PA
				Preparation of puppetry scripts	Pedagogical content knowledge	PCK
					Guidelines for puppetry	GFP
					Guidelines for script writing	GFSW
					School and community context	Ctx
				Preparation of lesson plans	Pedagogical content knowledge	PCK
					School and community context	Ctx
				Experiences	Lived experiences before	LEB
					Lived experiences during	LED
					Lived experiences after	LEA
					Transfer during	TD
Transfer after	TA					
Intervention						
4	<u>Primary research question:</u> What are intermediate phase mathematics teachers' lived experiences of an intervention based on pedagogies of play (puppetry) and metacognitive awareness to enhance Self-Directed Learning?			Experiences	Lived experiences before	LEB
					Lived experiences during	LED
					Lived experiences after	LEA
					Transfer during	TD
					Transfer after	TA
				Perceptions	Perceptions before	PB
					Perceptions during	PD
					Perceptions after	PA

4.2 Presenting and interpreting results

In Chapter 3, the research design and its interrelatedness with the methodology and conceptual framework were discussed in terms of four phases (see Figure 3.1). The results are also interpreted according to Figure 3.2:

- Firstly, sub-research question 1
- before the intervention occurred in an organised manner, then data analysis thereof commenced. The different categories and *a priori codes* were discussed separately.
- Secondly, data obtained from the reflective prompts during both of the workshops in the intervention were organised after each presentation. A summary of these findings allowed for integration against the background of the conceptual framework in order to allow for similarities, differences and additional contributions to the body of scholarship to emerge.
- Thirdly, data obtained from the observations during the second workshop with regard to an adapted lesson study approach, were organised. A summary of the findings (against the background of the conceptual framework and research questions) also allowed for similarities, differences and additional contributions to the body of scholarship to emerge on participant perceptions of a PoP (puppetry) and the integration thereof (metacognition) in participants' own teaching-learning praxis.

The results are accounted for based on an interpretation thereof. In Table 4.3, a synthesis is provided on each data collection instrument and how they are referred to in the text.

Table 4.3: Synthesis of data collection instruments and referencing thereof in the text

Data collection instrument	Participant and number	Line numbers
Semi-structured open-ended individual interviews	P1	1–5
Reflective prompts	RP	1
Observations	OW2	1 (page number)

References to participant responses (Table 4.3) pertaining to the relevant data are indicated as [P1:1-5], which is read as follows: participant [P], number of participant [1], lines 1 to 5.

With regards to the reflective prompts, participants completed two sets of reflective prompts during workshop one of the intervention as well as one set of reflective prompts during the second workshop of the intervention. Due to the nature of the reflective prompts, references to participant responses are indicated as [P1:RP1], which is read as follows: participant [P], number of participant [1], reflection prompt [RP], set number [1].

In terms of the observations, participant responses were indicated as [OW1:1], which is read as follows: observation [O], workshop [W], number [2] and the page number on which the observation was made and written down [1].

The two research lenses employed are indicated in quotes as follows:

Table 4.4: Synthesis of research lenses and referencing thereof in the text

Research lens	Indicated in this chapter as
Third-generation CHAT	THC
Rogan and Grayson model	R&G

These two lenses emerged throughout this study and are discussed in full in Chapter 6. The synthesis of these two lenses can be found in Chapter 3 (§§ 3.2.2.1 to 3.2.2.3).

4.3 Secondary research question 1: What are intermediate phase mathematics teachers' perceptions of pedagogies of play (puppetry) before and during the intervention?

According to the literature study, PoP can entail various strategies (card and board games; indigenous games, like Morabaraba; puppets; or even computer-based gaming). Participants' perceptions of PoP (puppetry – a physical resource) indicated the following based on their lived experiences prior to the intervention. In this study, PoP served as a tool [TGC] of which the profile of implementation [R&G] is given below.

4.3.1 Perceptions of pedagogy of play (puppetry) before the intervention

Participant responses highlighted that they had little to no experience of the implementation of PoP or how to engage therein “... *I do not know what a PoP is. I guess it is something about play*” [P1:25-28]. The limited knowledge of PoP participants had prior to the intervention was based on teacher factors such as personal background, level of training and teaching-learning confidence. These participants had a very holistic approach to teaching-learning overall. According to Farné (2005), PoP can be implemented with more ease when teachers have clear goals of the lesson in mind. Since these participants engaged in vigorous lesson planning, it seemed as if they were ready to implement a PoP (like puppetry) in their classrooms after the first workshop.

Participants were optimistic about the implementation of a PoP (puppetry) for the intermediate phase classroom prior to the intervention, although they did not have the teaching-learning experience: "... *strikingly different from what we are used to teach with and to teach by*" [P7: 687-688; P8:824-829]. As optimistic as they were, there was also a little uncertainty: "*So for the intermediate phase, I doubt if puppets are really going to make a change... most of the guys are going to see it as a joke*" [P5:428-431]. It would also move the teacher from a comfortable teaching viewpoint (comfort zone) to the unknown (due to little or no experience) with puppets.

It is important to note that participants (subjects) [TGC] must act as artists when engaged in a PoP (puppetry), since it entails drama (Korošec, 2012; Kröger & Nupponen, 2019). Two of the participants (P7 and P9) had previous experiences of teaching with puppetry in the Science classroom. Some participants acknowledged that they had never been introduced to PoP: "... *No, I was never introduced to it in the proper manner*" [P2:139; P4:323 and P5:424-425]. A few others integrated some form of play ("*... games we have been playing. I usually do, try to play games especially chess..., but uhm..., puppets will be new*" [P1:62-64; P10:1082-1084]) or concrete experiences into their lessons ("*... last term we had our 3D objects and we did send the objects around and the whole group could have a look, but it wasn't playful, but was more like a touch and feel*" [P8:817-819]). Although concrete experiences do not necessarily mean PoP, participants acknowledged the fact that it had sensory value.

Participants also believed that their learners learned mathematics "*through repetition*" [P2:116-117; P3:182; P4:293; P6:524-525]. Repetition as strategy could be based on socio-economic issues ("*... I think they learn mathematics so that they can be able to have help the parents at home with the counting*" [P4:287-288]), which acted as barriers to their learners' learning (OECD, 2012) and could also be linked to the challenges faced ("*... our children's attention span is very short and you will be surprised what happens to children, things that you know, we don't even..., you know, you hear stories*" [P7:688-689]) in rural and township schools. According to Hacker et al. (2009), Sabna and Hameed (2016) and Veenman et al. (2006), if teachers are constantly aware of how they teach and how their learners learn, their mathematical classroom would foster "good practice", since learners are engaged, challenged but can also be autonomous in their learning, leading to less repetition – all elements that could be fostered by a PoP by integrating puppets.

According to Brits et al. (2016), due to the dynamic nature of South African learners' rich cultural backgrounds, puppetry is a constructive and creative pedagogy that learners appeal to: "*It is also cost effective, easy and creative thing to do for these learners*" [P7:695-696]. This might have been the reason as to why participants were eager to implement a PoP (puppetry) – it could engage their learners more in teaching-learning.

4.3.2 Perceptions of pedagogy of play (puppetry) during the intervention

It was interesting to note how participants transferred their newly gained knowledge to their own teaching-learning praxis when engaging in lesson planning. The tenets of mathematics (see § 3.2.2.1) allowed them to incorporate lesson planning templates, guidelines for puppetry and script writing as well as CAPS (DoE, 2011) while collaborating with peer participants. Participants took a facilitative standpoint (as portrayed by their lesson planning), since the problem that their puppet faced (plot of the script) would allow for learners to engage with content and discover the mathematical ideas behind it for themselves. Participants once again acted as reflective practitioners as they employed their existing PCK, incorporated the rules [TGC] (as mentioned), and infused the lesson with the context of the school as one of the participants mentioned to a colleague: *“How will my (pointing finger to herself) learners understand it?”* and *“How am I going to perform with more than one puppet?”* (OW2:1). This is also evidence of participants being reflective teachers. These questions once again served as reflective thinking, since participants became more aware of what they were doing during their lesson planning and script writing, for whom they were doing it (person – learners) and why they were doing it (pertaining to CAPS as “rules”) [TGC].

The physical resources [R&G] (lesson plans; puppets and puppetry scripts) provided participants with a “hands-on” strategy during the adapted lesson study session as some of them even performed (tested) their scripts on their peers. The experience (and transfer) during this session allowed participants’ first “solo endeavour” in applying a PoP (puppetry) to the teaching-learning of intermediate phase mathematics.

One participant in particular (P5) noted in his semi-structured open-ended individual interview (see § 4.3.1) that puppetry was more fitting for foundation phase” ... *So for the intermediate phase, I doubt if puppets are really going to make a change... most of the guys are going to see it as a joke*” [P5:428-431]. He gained a new perspective, according to his reflective prompt answer set, and noted the following on the importance of puppetry in the intermediate phase:

• I have a very new perspective about the puppetry. The learners will be more engaged in the classroom.

[P5:RP1]

Although participants also firmly believed in repetition of content as a manner in which their learners' learning was optimised (see § 4.3.1), their perceptions shifted slightly, since the creative integration of puppetry allow for *"information to be given through a more creative manner from the educator to the learner"* [P10:RP1]. This could possibly lessen the number of times content need to be repeated due to its creative nature, leading to improved retention of content: *"... the fact that through play, repetition takes place less, because learners take a lot more in"* [P8:RP1]. These perceptions are in accordance with findings of the Karyn Purvis Institute of Child Development, stating that less repetitions are necessary for new synapses to be formed in the brain when done through play (Wilson, n.d.)

In a recent literature study done by Kröger and Nupponen (2019), they found that puppetry allows for five domains in teaching-learning to surface, namely: (i) generating communication: *"... listening to each other and sharing of ideas"*; (ii) supporting a positive classroom climate: *"... motivates positive attitudes"*; (iii) enhancing creativity: *"... fun interesting; creative; enjoyable and active pedagogy"*; (iv) fostering co-operation in and integration into a group: *"... (iv) easing group work"*; (v) changing attitudes: *"... broadening of learner thinking and curbing disruptiveness and learner retention of content"* [P6:RP1; P7:RP1; P8:RP1; P9:RP1; P10:RP1; P2:RP3]. Advantages like these also correlate with the multiple intelligence theory (Gardner, 1993) as learners are developed in terms of multiple individual intelligences (see § 2.3.6). From the results, it seems that the domains as indicated by Kröger and Nupponen (2019), also correspond with the study conducted by Mardell, et al. (2016), where a PoP [puppetry] allowed learners to take risks, make mistakes and explore new ideas.

The implementation of puppetry into participants' respective mathematics classrooms provided a holistic and positive feel to participant responses, which could also be considered to be advantageous. Participants' responses corresponded with studies by Ahlcrona (2012), Korošec (2012) and Remer and Tzuriel (2015) where a positive classroom environment (based on the three-dimensional symbolic artform of puppets, such as visual appearance, movement and speech) allows learners to view the puppet as a "peer" who, too, faces difficulties in mathematics but overcomes them by always seeking to find a solution, which is motivating.

The disadvantages that participants mentioned included: *"time consuming; unstructured way to teach [anything can happen – implementation difficulty]; learners making fun of puppets and discipline related issues; loss of interest"* [P6:RP1; P7:RP1; P8:RP1; P9:RP1; P10:RP1; P2:RP3]. Although numerous disadvantages were identified, the number of advantages outweighs the disadvantages mentioned by the participants.

In contrast to the disadvantages perceived by participants, research conducted by the following authors contributes towards the understanding that such disadvantages could be overcome (Table 4.5).

Table 4.5: Interconnectedness of literature on the qualitative findings

Disadvantages of PoP (puppetry) as perceived by participants	Authors contrasting the disadvantages	Description
* Time consuming	Farné (2005)	Design and management of puppetry during lessons are easier for teachers (participants) with clear goals in mind – such as knowing where the lesson is going, hence being metacognitively aware of every aspect of lesson planning, monitoring and evaluation relating to the person (learners), task and strategies to meet lesson outcomes.
* Unstructured	Baumer (2013); Girvan (2016)	Traditional approaches and structuring of teaching-learning no longer suffice for the 21st-century learner, since new and innovative approaches (like PoP – puppetry) are more appealing, enhancing overall teaching-learning.
* Difficult to implement	Hackling et al. (2011); Remer & Tzuriel (2015)	Not all teachers benefit in working with puppets, since they are not confident at first. Prolonged application and re-application may inform their (participants') teaching-learning praxis to such an extent that puppets automatically form part of their respective mathematics classrooms.
* Discipline issues	Acharya (2017); Whiteland (2016)	Classroom disruptiveness may stem from having a negative attitude towards mathematics, leading to uninterested learners. Puppetry allows for enhanced classroom participation on account of learners, subjecting this negative attitude and transforming it to a positive outlook, since learners find the mathematics meaningful and understandable.
* Prolonged use – loss of learner interest	Gobec (2012)	Can be implemented over a prolonged period of time if it is applied or integrated creatively into different teaching-learning contexts

Participants may not have really been exposed to teaching-learning experiences with a PoP (puppetry) in their respective intermediate phase mathematics classrooms, hence they perceived these disadvantages. These disadvantages could also have surfaced as possible tensions, hampering the possible integration of PoP (puppetry) after the intervention. Literature and previous research illustrate that these disadvantages may be overcome should participants feel that they want to integrate a PoP (puppetry) gradually in the future in their respective mathematics classrooms.

4.4 Synthesis of secondary research question 1

Based on the responses from participants, it seemed as if their perception of PoP (puppetry) before and during the intervention was positive overall: *“I am always open to learn and just to develop myself, but in that way I do not only develop myself for myself, I develop myself so that others [learners] can benefit through it”* [P3: 233-236; P6:557-558]. This might indicate a willingness among them to integrate a PoP (puppetry) after the intervention in order to account for a different approach to teaching-learning in mathematics, which both teacher and learner benefit from. The examination (performance)-driven nature of our schooling system allows little time for participants to explore other pedagogies (Ramnarain & Shuster, 2014; Thompson, 2013). The identified advantages and disadvantages could also indicate that participants reflected on their own classroom teaching-learning praxis and how learners would perceive a PoP (puppetry) in order to integrate it more successfully. Therefore, they may act as agents of change [TGC] in their respective classrooms, implementing a PoP (puppetry) which is not common, especially in the intermediate phase mathematics classroom. These agents of change [TGC] aligned with the object of the intervention [TGC], since they engaged in script writing and became more aware of their teaching-learning praxis.

4.5 Secondary research question 2: What are intermediate phase mathematics teachers’ perceptions of metacognitive awareness before and during the intervention?

The interconnected nature of metacognition (making it a complex “fuzzy” concept [Flavell, 1979]), allowed for results to emerge on participants’ metacognitive knowledge (person, task and strategy knowledge) as well as self-regulation (entailing planning, monitoring and evaluation), all of which contribute to their overall metacognitive awareness, “glued” together by reflection and illustrated as follows:

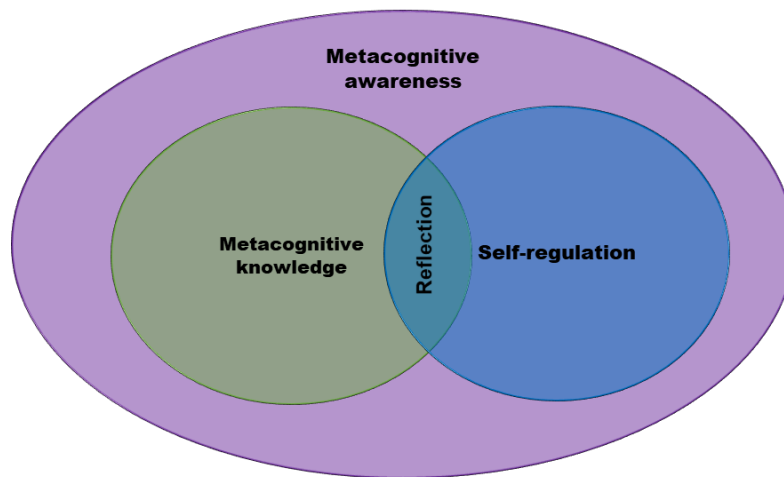


Figure 4.1: The interrelatedness of metacognitive knowledge and self-regulation and how they contribute to metacognitive awareness

(adapted from Flavell, 1979; Van der Walt [in press])

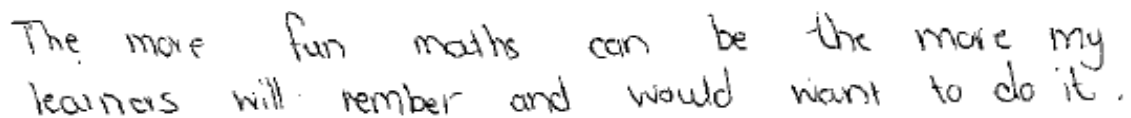
The reflective prompts allowed participants to evaluate what they had learned during the session on metacognition by reflecting, hence allowing their metacognitive awareness to surface. Participants reflected on puppetry in their respective intermediate phase mathematics classrooms and reflected on their learners, schools and overall teaching-learning. Overall, metacognition was perceived as being able to improve participants' teaching-learning praxis, since "*metacognition means that you have to think about every aspect of your thinking and make improvements*" [P8:RP2; P9:RP2]. Hence the participants had to engage in self-talk, reflecting as a person (their knowledge of the tenets of intermediate phase mathematics and PCK), their ability to set tasks, and the strategies they employed to teach their learners. Participants also had to reflect on taking the learner into account as a person (multigrade teaching; socio-economic issues), the tasks learners had to accomplish in order to meet lesson goals or outcomes, as well as the strategies learners were (or had to be) equipped with in order to successfully accomplish the task.

4.5.1 Perceptions of metacognitive knowledge before and during the intervention

Participants shared lived experiences of metacognition before and during the intervention, and it was interesting to note how hard they worked on their lessons based on metacognitive knowledge of the person (they themselves and their learners), task setting despite their school context, multigrade teaching [TGC] or teaching big classes and the strategies they used (or ways they taught). The participants knew their learners' needs very well and it was a good guideline for them to plan lessons based on this "person(al)" knowledge, since they "*still do research to see what is at my learners' level* [translation]" [P7:651-652]. They usually reflected on work done in previous years on the concept or topic at hand that had to be taught, since they "*must always be*

there for the kids and make sure that when a child does not understand, I [they] must go back" [P3:225-226; P4:306-307; P8:842-854].

Knowledge about the person (self and learners) was essential as it conveyed knowledge to the participants as to how their learners (and they themselves) understood mathematics content and how they taught so that learners could easily make sense of what they taught, allowing learners to master their particular Grade (see Table 2.4 in Chapter 2). Hence participants reflected on the application of puppetry as PoP in their classroom and they believed that their learners would benefit:



The more fun maths can be the more my learners will remember and would want to do it.

[P1:RP1; P7:RP1]

Metacognitive knowledge concerning task and strategy allowed participants to integrate real-life examples, linking learners' prior knowledge to solve given problems: *"I usually give my children the freedom to do their own method, they can do it their way... If that works for them, then that works for me"* [P7:725-728]. Using real-life examples allowed learners to implement various strategies of their own to solve problems, which is a holistic and creative approach from participants themselves: *"I start at home so that they can give me feedback on what they see in the homes, around them, in their neighbourhood [translation]"* [P10:1050-1052]. This possibly indicates that participants were not "confining" their learners' learning to the application of specific strategies. Linking real-life examples were strategies that participants implemented as they could lead to improved achievement of lesson outcomes (Crescenzi, 2016).

During the intervention, metacognitive knowledge also emerged in a more personalised format when participants engaged in the adapted lesson study session in workshop two of the intervention. Metacognitive knowledge of the task to plan a lesson and to infuse it with puppetry allowed for the following behaviours to surface: *staring at the ceiling, rubbing of chin, biting of lips, holding face in hands, tapping on table with finger or pen and laughing* [OW2:2], indicating possible thought-like (thinking) behaviour.

These behaviours were observed as participants discussed their scripts, lessons and puppets, indicating a possible relationship towards new knowledge the intervention provided (experiences) and how they were going to transfer it to their respective intermediate phase mathematics classrooms, hence implying metacognitive knowledge. The behaviours and questions that surfaced in the adapted lesson planning session might be indicators of how well participants knew (or were aware of) the tenets of mathematics [THG], since *"then I now know exactly what my*

outcomes will be, what type of questions I should put into the activities, and so on [translation]" [P4:341-342; P5:439-441].

Metacognitive knowledge allowed participants to think about the implementation of metacognition in their daily teaching-learning praxis, since they *"ask the learners how they see the problem or concept in their own words"* [P7:RP1] and use real-life examples to assist learners with tasks and strategies.

Participants also considered metacognitive knowledge as beneficial to their own thinking processes and praxis and how it would assist their learners: *"[i]t has taught me to be more aware of my thinking process. Also how to help my learners to think more open about problems in mathematics..., and to express their opinions and understanding of the problem"* [P1:RP2; P6:RP2], hence possibly assisting in improved planning, monitoring and evaluating.

4.5.2 Perceptions of self-regulation before and during the intervention

Participants' metacognitive awareness of their planning, monitoring and evaluation of their lessons was based on their metacognitive knowledge of their learners (person), the tasks they set and aligned with their outcomes as well as their teaching strategy and their learners' personal learning strategies. Therefore, metacognitive awareness serves as a capacity to support innovation [R&G] but depends on the knowledge of these components of self-regulation (implying teacher factors – R&G).

As mentioned earlier, participants were not aware of the fact that they incorporated metacognition (metacognitive knowledge and self-regulation) into their daily teaching-learning routine: *"... we always have been thinking that way but never even knew"* [P1:RP2]. Participants emphasised that the essence of what metacognitive awareness entails would instil an awareness to be more critical of their teaching-learning praxis as well as their learners' learning (*"... I can be more aware of my thinking processes and also instil this way of thinking in my learners"* [P1:RP2]), therefore allowing for a capacity for innovation [R&G] as participants were likely to be more aware of how they planned lessons, were going to monitor learners and were going to evaluate by employing the reflective journals at the end of their lessons where they incorporated puppetry during the adapted lesson study session in workshop two of the intervention.

As facilitators, my study supervisor and I worked with the participants and questions that surfaced were along the lines of: *Will this work?... ; Is this what I am currently planning, okay?...* and, ... *Can I rather write a puppetry script from scratch or does it have to be along the lines of an indigenous story?...* (OW2:1). These questions were all part of participants' metacognition, since they constantly reflected on their learners (person), the task they were going to give to their learners by employing puppetry as a tool [TGC] and the strategies to teach with puppetry, allowing for understanding to be reached by the learners.

The overall planning in which participants engaged revolved around the learners and allowed them to *"look for what's going to be interesting to them, what's not going to bore them"* [P9:91-92; P2:153-156; P4:339-341; P7:653-656] in order to *"see how I'm going to approach it, what's going to be my approach with my different classes. I really try to do this with different strategies so that the lesson can be on the level of the learners"* [P7:653-656]. Some participants planned additional activities for fast-working learners (*"... these few kids or the kids in this group, you are welcome to go on with this number and then I'd start from scratch with the rest of the class"* [P7:722-725; P8:856-858]) allowing for additional time to discuss the essence of the lesson with those learners who were still struggling.

As participants collaborated during the adapted lesson study session in workshop two of the intervention, the following questions surfaced (addressed by us as facilitators or peer participants): *This will not work because... ; We use a different textbook, would you like to use it to plan your content?; How many characters are we going to use in this script?; and ... What will our problem (plot) be?* [OW2:2]. This possibly indicates how detailed participants planned their lessons and infused their written puppetry scripts.

Participants noted that awareness in their planning, monitoring and evaluation may lead to *"more exciting lessons that is less boring, enabling understanding of the problem and less deviation from learning goals"* [P10:RP1; P6:RP2]. According to Gravett and De Beer (2015), planning (planning ahead) improves general teaching-learning praxis and assists in preventing misconceptions, hence assisting participants with overall time management. Though a PoP (puppetry), difficulties in the mathematics classroom can be minimised, since *"we can learn through play that can also be a meaningful manner to tackle difficulties in the mathematics classroom"* [P9:RP1], which can direct planning, monitoring and evaluation in an improved manner.

Participants tended to monitor their learners frequently and integrated tools [TGC] like checklists or questioning by *"introducing different levels or questions which allow me to identify those who are excelling and those who are actually having difficulties"* [P3:261-262; P10:1127-1128]. Since monitoring can be considered as the "meter of effectiveness", it provides the teacher with insight

into the impact of pedagogies employed in order to determine learner engagement and progress (Zumbrunn et al., 2011). In this case, participants acted as facilitators, asking questions or trying different strategies to ensure learner understanding.

Although not all participants did formal reflection (taking notes of the class' progress during that particular lesson), most of them made "mental notes" and changed their teaching-learning praxis for the next class or future lessons on that particular topic. A few participants implemented checklists to *"improve my teaching, what interventions are needed... where I stopped and where I should I go back or follow up"* [P1:163-165], assisting with their overall reflection to establish *"did the learner ...uhm..., understand my work? Did the learner know exactly what they have to do after I have given them the work to do?"* [P4:350-352]. These reflections assisted participants to determine what worked and what did not work during their lessons, since they had knowledge of different ways in which their learners understood mathematics content. This could lead to adaptation and enrichment of future teaching experiences (see Table 2.4).

Since reflection is "the glue" that keeps metacognitive knowledge and self-regulation together to create a teaching-learning experience for learners, participants viewed evaluation as *"a platform to improve upon"* [P6:RP2]. Reflection also allows for *"asking 'why' and 'how' in order to reflect on your own thinking"* [P7:RP2]. Two participants "defined" metacognitive awareness as *"thinking of planning, action and the outcome"* [P8:RP2] and *"to think about what you did wrong to back and rectify it"* [P9:RP2]. According to Ertmer and Newby (1996), when teachers reflect, they become critical about their teaching (and learning) praxis, which is a crucial element to develop expert learners. Despite the challenges these participants faced in their respective classrooms, (such as the lack of resources), the fact that they were more aware of metacognitive processes may have led to a transfer thereof to their learners, allowing them to apply reflection before, during or after their tasks, which is a model for "good" teaching-learning practice.

4.6 Synthesis of secondary research question 2

The questions pertaining to the reflective prompts addressed the essence of teaching-learning with puppetry as educational (pedagogical) tool [TGC], and it was interesting to note how the rules [TGC] (pertaining to CAPS [DoE, 2011] and guidelines to write puppetry scripts) were incorporated in lesson plans. Participants' various lived experiences and transfer of what they had learned during the workshop could possibly be linked to the knowledge they had gained during the intervention up until then. Teaching-learning experiences of their own school and learners allowed them to realise what might work and what might not work based on their discussions amongst each other, hence the surfacing of metacognitive awareness of their respective teaching-learning praxes.

Participants' overall perception of metacognitive awareness before and during the intervention shifted from unfamiliarity to having knowledge thereof, since they realised that metacognitive awareness was embedded in their daily teaching-learning praxis. Participants' knowledge of their metacognitive awareness may have allowed them to be more creative and innovative when planning lessons, infusing them with a PoP (puppetry) accompanied by a puppetry script to enhance teaching-learning in the intermediate phase overall.

4.7 Secondary research question 3: How do intermediate phase mathematics teachers prepare lesson plans and puppetry scripts to implement in their classrooms before and during the intervention?

In order to answer secondary research question three, it is important to note that the way in which participants planned lessons, depended on various factors (such as teacher and learner factors [R&G – see Chapter 3, § 3.2.2.2] and school context – community [TGC – see Chapter 3, § 3.2.2.1] and the environment). Participants' perceptions as to how they taught mathematics (teacher factors [R&G]; multigrade teaching; school and community context and CAPS [DoE, 2011]) and how their learners learned mathematics were used to establish how participants planned lessons and why they planned it that way.

Participants said that teaching-learning of mathematics is not something one simply does, but that one *“need[s] to develop the child holistically”* [P7:692-695; P4:242-283], which is in accordance with one of the main ideas in CAPS (DoE, 2011), asserting that mathematics should be taught in a manner that contributes to the learners' personal (overall) development.

Participants' overall positive and holistic approach to teaching-learning allowed them to bring different resources [TGC & R&G] (such as CAPS [DoE, 2011], lesson plan templates, textbooks) to the second workshop to assist them with their adapted lesson study session. They regarded each other as a physical resource [R&G]: *“went to my fellow teachers and explained to them how great the lesson worked using the puppet”* [P10:5]. These resources (physical and human by nature) all contributed to participants' knowledge of the tenets of mathematics [TGC], since they were based on participants' beliefs of the teaching-learning of intermediate phase mathematics.

Participants were able to reflect in detail on how they outlined lesson planning by *“firstly looking at the time frame, the topic, the theme, the different concepts which learners should grasp, what I [they] would like to achieve, how I [they] will go about in achieving them, which worksheets to employ and all equipment and assessment strategies needed”* [P1:91-92; P2:153-156; P4:399-341; P7:653-656]. Responses like these may indicate that participants knew exactly where to

start when planning lessons and how to go about when integrating various resources in order for their learners to reach lesson goals optimally, which is also characteristic of SDL (Knowles, 1975).

Body language

As participants engaged in the adapted lesson study session, body- and spoken language, such as *biting of pens, looking into the distance, rubbing of foreheads and saying “uhm” or “I think that”* (OW2:2), could have been indicators of the implementation of metacognitive knowledge of person (their learners), the task (writing a puppetry script and mathematising it) and strategies (incorporating rules [TGC] to achieve the task successfully) to plan a lesson for their respective mathematics classrooms. Therefore, participants were in the process of formulating teaching-learning goals and chose and implemented accompanying teaching-learning strategies that were characteristic of SDL (Knowles, 1975).

According to Kirsh (2010), when individuals use their body to think, it is regarded as an instrument of their cognition, since body language (and spoken language) is an anchor for thought (critical reflection), hence embodied cognition. Participants' metacognitive awareness that surfaced via body and spoken language was an extension of their thoughts – the embodiment (ESDC – see Chapter 2, § 2.4.3.3.3) of their own understanding – since they expressed it in physical or verbal form (Murray, 2011). Therefore, participants' behaviour (body and spoken language) were closely observed in order to establish possible metacognitive thought processes.

Multigrade teaching

Although the participating schools came from multigrade teaching situations, only two teachers were teaching multigrade classes (Grades 6 and 7). The other participants had taught (or had knowledge of) multigrade teaching, contributing to innovative teaching-learning praxis. Although participants were innovative in their teaching-learning approaches, it also surfaced as a tension, since *“it is a daily battle for me that learners understand and when learners do not understand, how do you fill that gap? Continuously, day after day, period after period with the multigrade learners in my classroom. It is mentally draining and also exhausting. You can't keep that up”* [P9:948-952; P8:782-784]. These tensions that participants faced in the multigrade classroom corresponded with the study done by Msimanga (2019), who reported that multigrade teaching often results in poor learner participation, requiring a creative and innovative pedagogical approach by the teacher to enhance learners' learning and engagement.

Context of school

The context of the school also served as a community [TGC] from which participating teacher colleagues shared their insights and planned their lessons. The availability of physical resources [R&G] was also a determining factor for their hard work in preparing adequately for their learners despite school challenges (such as underresourced classrooms and language of teaching-learning). Participants' holistic approach to teaching-learning could be due to the fact that their school context (rural and urban – mostly disadvantaged communities' learners in underresourced classrooms) necessitated them to be innovative and creative in order to make mathematics meaningful to their learners, where they *“try to accommodate all the learners..., it's difficult, because your classes are big”* [P1:43-44; P2:111; P7:754]. Innovative and creative approaches like a PoP (puppetry) also allowed participants to reflect thereon as *“making topics more exciting and less boring”* [P10:RP1], which may contribute to enhancing learners' teaching-learning experiences in the intermediate phase mathematics classroom, hence making it an environment where they want to be.

Curriculum document

Even though participants taught in disadvantaged communities, they were still positive in their teaching-learning praxis and gave their all for their learners. The context of the school determines the need to offer an all-inclusive teaching-learning space (approach) (OECD, 2012). This is already problematic by nature, since teachers do not always have adequate PCK or resources to pursue these kinds of approaches, or are pressed for time: *“... it is sort of a squishing in, because there is really no time”* [P2:131-132] due to the pace setter as prescribed in CAPS (DoE, 2011).

CAPS (DoE, 2011) and its accompanying pace setter (annual teaching plan for teachers to work through all of the content of a specific Grade) features as rules [TGC] for all teachers and are deemed as a physical resource [R&G] that is deeply intertwined with any teaching-learning praxis. Although participants felt strongly about the fact that teaching-learning should stem from a holistic approach, *“you still need to instil values and norms and prepare the child for life”* [P7:692-695; P4:242-283]. This reference was made to tensions regarding time management as stipulated by the CAPS document. Time management pressurised participants as they felt that they *“sometimes move on too quickly to the next lesson, because of the pressure of the CAPS curriculum puts on me as a teacher”* [P2:131-132; P8:787]. Pace setters pertaining to CAPS (DoE, 2011) dampen effective implementation or re-implementation of a PoP (puppetry), *“so we try to get to everything, but ja, the CAPS doesn't really allow a lot of time for that”* [P8:845-846].

According to Hill et al. (2008), high-quality teaching-learning of mathematics depends on vigorous time and energy spent by teachers to develop supplemental resources they could apply to their lessons – therefore CAPS serves as a capacity to support innovation [R&G]. The tensions time constraints place on participants' teaching-learning praxis, links to their task knowledge concerning metacognitive knowledge (see Table 2.4). It is an advantage that teachers are aware of tensions like these as they may contribute to a more "to-the-point" lesson on their topic that they are to teach in their respective classrooms.

The learners in the respective participants' classrooms could also be regarded as part of their community [TGC] with various learner factors [R&G] which they need to take into account when teaching them. Participants also used various teaching-learning strategies, such as peer learning, in their praxis, *"because, sometimes we as teachers are barriers to these learners, it helps if another kid sometimes explains that topic a bit better. Peer learning is very important"* [P3:264-266; P9:1006-1009]. Participant 9 used art for teaching-learning, since *"you can link mathematics to art, it becomes enjoyed"* [P9:920-922]. The fact that participants in this study had to act as artists when employing a PoP (puppetry) – since it is linked to drama – may also surface as a tension, since not all teachers are accustomed to this manner of teaching-learning.

As mathematics has its own "language" (such as grammatical patterns, rules and notation), the language of teaching-learning should accommodate learners (who are being taught in a different language than their home language) so that they can understand the unique meanings behind the "mathematical language" (Macmillan Education South Africa, 2018; Suffolk, 2007). The language of teaching-learning allowed for various tensions (such as enhanced understanding of content) to surface, since participants got *"learners to actually do language skills as well to try just to understand it [content] a bit better"* [P8:794-795; P2:134; P6:491-492]. The school's medium (language) of instruction were mostly not the learners' (or participants') home language.

4.8 Synthesis of secondary research question 3

The way in which participants prepared lesson plans could be regarded as a rigorous process where they took numerous factors (such as language; socio-economic circumstances; CAPS [DoE, 2011]; guidelines for puppetry; guidelines for puppetry script writing and multigrade teaching) into account. During the intervention, participants did not have difficulty with lesson planning itself. The fact that they all engaged (and enriched) each other's lessons by collaborating in the process, allowed them to be agents of change (Singh, 2018) in their respective teaching-learning praxes. Although participants received puppetry guidelines and puppetry script writing guidelines, it was a new experience to them. They had to infuse lessons with their own scripts and use the puppets to enrich the overall teaching-learning experience as well, which was

unknown “territory” for participants. Therefore, the writing of puppetry scripts was experienced as a difficult process which moves participants “... *out of my [their] comfort zone[s]*” [P8:RP3; P10:RP3], since it may not have been in all participants’ nature to be artistic and think artistically.

4.9 Overall interpretation of results and the intervention

The intervention served as another capacity to support innovation [R&G]. Regarding participants’ lived experiences before the intervention, it seemed as if a PoP (puppetry) was an educational (pedagogical) tool [TGC] and they deemed to be appropriate to implement as they felt that “*the only thing is that they need to imply it [PoP – puppetry] in the whole school. All the subjects. I think it will be an eye opener*” [P1:104-106; P2:169-170].

Since participant professional development for this study was based on Warford’s (2011) ZPTD, participant responses prior to and during the intervention (the data presented in this chapter) correlated with three of the stages of the ZPTD. Table 4.6 illustrates these stages and how they apply to the overall study.

Table 4.6: Participant professional development pertaining to the ZPTD and intervention

ZPTD stages (Fani & Ghaemi, 2011; Warford, 2011)	Data collection instruments used before and during the intervention	Description and explanation
Self-assistance stage	Semi-structured open-ended individual interviews	The input they had given in these interviews was based on prior experiences of and beliefs about teaching-learning of intermediate phase mathematics. The self-assistance stage was used as departure point of participants’ actual level of development with regard to metacognition and PoP (puppetry).
Expert other assistance stage	Reflective prompts	Participants’ knowledge was deepened, activating improved reflection on their teaching-learning praxis, while sharing it with knowledgeable others. Therefore, these participants could be regarded as reflective practitioners. Reflections are merely one of the teaching factors that is part of their array of strategies in their division of labour [TGC] in order to teach their intermediate phase mathematics learners in a meaningful way.
Internalisation stage	Observations	Participants’ application of newly attained knowledge for demonstration purposes where the intervention allowed for a practice situation, led to internal growth of participants’ teaching-learning praxis. This stage informed participants as to how they were going to apply PoP (puppetry) in their classrooms and when by consulting peers and collaborating with us as facilitators (expert others).

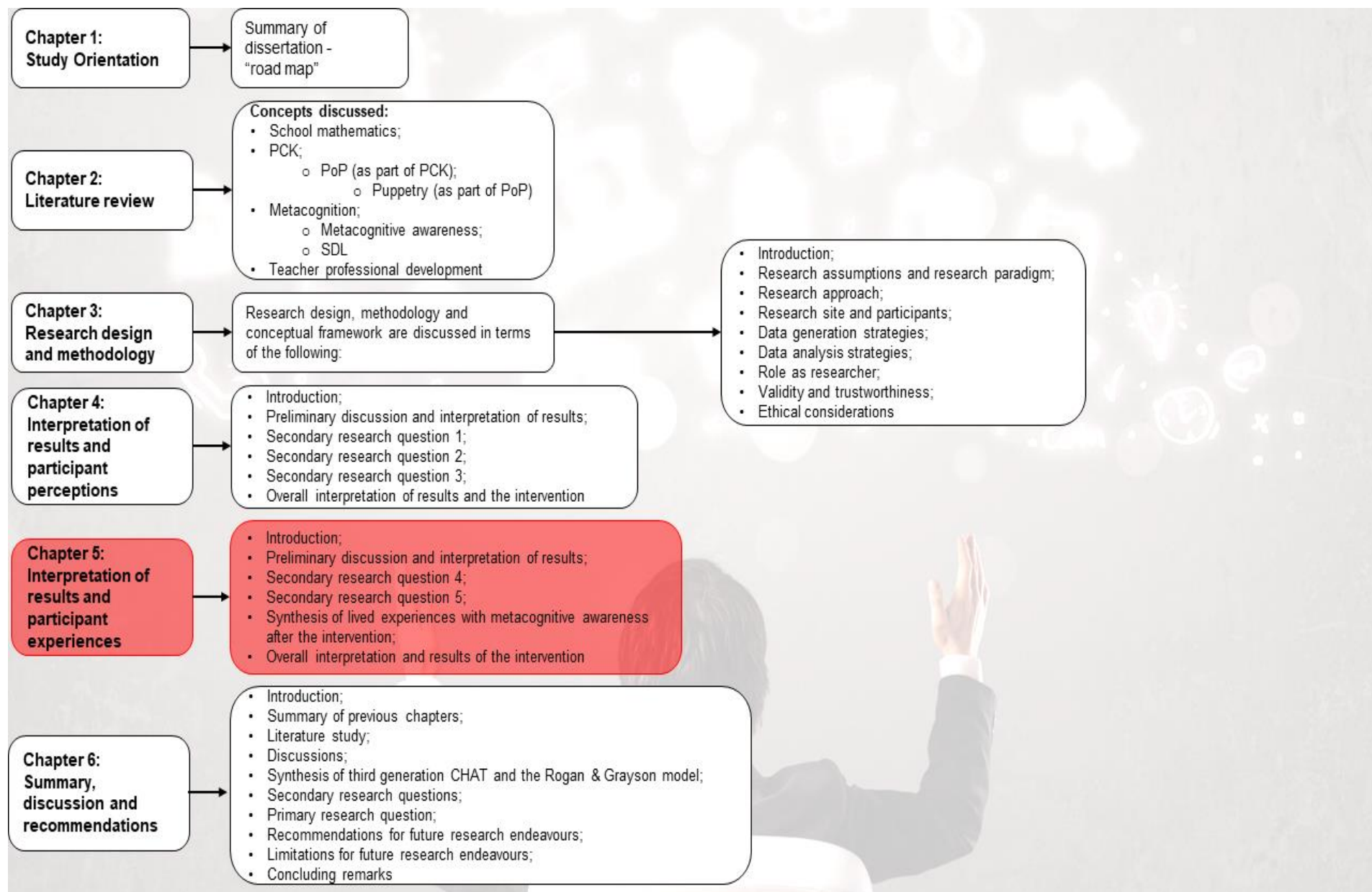
(adapted from Fani & Ghaemi, 2011; Warford, 2011)

In Table 4.6, according the intervention, the ZPTD allowed for participants to develop their knowledge at a more proximal level, which accounts for growth in their overall PCK pertaining to their teaching-learning praxis of intermediate phase mathematics.

4.10 Chapter summary

In this chapter, I answered the first to third secondary research questions as accurately as possible. Chapter 5 reports on the data analysis and presents the results that emerged from the post-focus group interview and the reflective journals submitted by participants.

“Great things are not done by impulse, but by a series of small things brought together”
(Vincent van Gogh)



CHAPTER 5: INTERPRETATION OF RESULTS AND PARTICIPANT EXPERIENCES

5.1 Introduction

In Chapter 4, results and interpretations that emerged from the first three secondary research questions related to participant perceptions of PoP [puppetry] and metacognitive awareness before and during the intervention. The interpretation of results in this chapter relating to secondary research questions four and five, were based on participants' experiences of implementing and transferring PoP [puppetry] and metacognitive awareness.

In this chapter, data were analysed by means of narrative analysis (for the focus group interview) as proposed by Creswell (2014), and hermeneutical analysis (for the reflective journals) as proposed by Nieuwenhuis (2016). Narrative analysis for the post-focus group interview was deemed to be appropriate as participants gave account of their own "stories", sharing their perceptions and experiences (in this case) after the intervention. Moreover, hermeneutical analysis was considered as appropriate for the reflective journals as participants gave account of their experiences ("account through participants' eyes"). The integration of literature as well as the three data collection instruments described in this study strengthened data triangulation, since they allowed for coherent overarching themes, subthemes, categories and codes to emerge, contributing to the overall validity of this study (Creswell, 2014).

Similar to Table 4.1, Table 5.1 illustrates the research question and secondary research questions pertaining to this chapter, the interrelatedness with the data collection instruments, the subsections pertaining to the discussions thereof as well as the link between the subsections are presented.

Table 5.1: Research questions and interconnectedness of data collection instruments used in this study

Column A:	Column B:	Column C:	Column D:	Column E:
Research question or secondary research questions	Chapter pertaining to research question or secondary research questions	Data collection instrument(s) pertaining to research question(s)	Subsection(s) in chapter pertaining to research question or secondary research questions	Link between subsection(s) and research question(s)
* Research question: What are intermediate phase mathematics teachers' lived experiences of an intervention based on pedagogies of play (puppetry) and metacognitive awareness to enhance Self-Directed Le?	Chapter 4 and 5	(i) semi-structured open-ended individual interviews; (ii) reflective prompts; (iii) observations; (iv) post-focus group interview and; (v) reflective journals	4.3.1.1.4 4.4.1.1.3 4.5.1.1.4 5.2.1.1.4 5.3.1.1.4	Since all the secondary research questions aim to address the primary research question, all the subsections pertaining to each secondary research question (Column D) should be considered here as listed already. Participants' lived experiences of the intervention specifically, were captured (indicated in Column D), indicating participant growth along the ZPTD as suggested by Warford (2011).
* Secondary research question 4: What are intermediate phase mathematics teachers' lived experiences of the transfer of pedagogies of play (puppetry) after the intervention?	Chapter 5	(iv) post-focus group interview and; (v) reflective journals	5.2.1.1.3 5.3.1.1.3	Participants' lived experiences, as captured after the intervention, of the implementation (transfer) of knowledge with regard to PoP (puppetry) can be seen in Chapter 5 (see Column D).
* Secondary research question 5: What are intermediate phase mathematics teachers' lived experiences of the transfer of metacognitive awareness after the intervention?	Chapter 5	(iv) post-focus group interview and; (v) reflective journals	5.2.1.1.2 5.3.1.1.2	Participants' lived experiences as captured after the intervention of their metacognition (metacognitive knowledge and metacognitive awareness) can be seen in Chapter 5 (see Column D).

5.2 Preliminary discussion and interpretation of the results

Note that the interpretation of the results in this chapter relates to secondary research questions four and five of this study where the focus is placed on participants' experiences with a PoP [puppetry] and metacognitive awareness after the intervention.

Firstly, a post-focus group interview strengthened the interpretation of results regarding participants' understanding of PoP (puppetry) and their metacognitive awareness in reflecting thereon are presented and contextualised in the literature.

Secondly, participants had to submit reflective journals based on their teaching-learning experiences with puppetry concerning the lesson they had developed and had written the puppetry script for during the intervention. This summary was also compared against the background of the conceptual framework to allow for similarities, differences and additional contributions to the body of scholarship to emerge regarding participant experiences with a PoP (puppetry).

In Table 5.2, a synthesis of each data collection instrument and how it is referred to in the text, are provided.

Table 5.2: Synthesis of data collection instruments and referencing thereof

Data collection instrument	Participant and number	Line numbers
Post-focus group interview	P1	1-5
Reflective journals	P1	5

Note that references to participant responses are indicated as [P1:1-5], which read as follows: participant [P], number of participant [1], lines 1 to 5, post-focus group interview. References made to participant responses relating to the reflective journals are [P1:5], which is read as follows: participant [P], number of participant [1], question 5.

The two research lenses employed are indicated as follows:

Table 5.3: Synthesis of data collection instruments and referencing thereof

Research lens	Indicated in this chapter as
Third-generation CHAT	THC
Rogan & Grayson model	R&G

These two lenses emerged throughout this study and are discussed in full in Chapter 6. The synthesis of these two lenses can be found in Chapter 3 (§§ 3.2.2.1 to 3.2.2.3).

5.3 Secondary research question 4: What are intermediate phase mathematics teachers' lived experiences of the transfer of pedagogies of play (puppetry) after the intervention?

Participants were asked whether (if at all) their perceptions had changed since the first workshop on puppetry as PoP to teach intermediate phase mathematics, and participants mentioned that *"it changed my [their] perception. You make learning easy and its fun and it is going to make that last little bit of difference that I really do need in the classroom"* [P10:41-45; P1:25-29]. The shift in perception (feeling hesitant to implement a PoP [puppetry] to perceiving puppetry as influential to teaching-learning in the intermediate phase mathematics classroom) might be because participants were exposed to what PoP means, what puppetry entails and how metacognitive processes might assist in transitioning (transferring) to and from the application of puppets, thereby instilling more confidence in participants to be agents of change [TGC] and to incorporate puppetry in their respective classrooms.

Another participant mentioned that puppetry might assist them in teaching in a more orderly (conduct) way, since *"it helps to discipline the educators., for example when I introduce Bokkie* [puppet] to my class, the kids were not listening and I wanted to shout at them and I was like you know, I want to shout, but I can't, because Bokkie* is here"* [P10:86-88]. The fine art of a positive classroom environment where the puppet could freely make mistakes and the learners accepting the challenge to also make mistakes (and recognise and fix them [Ahlcrona, 2012]) is something that might be challenging for participants, since they would have to keep in mind that the puppet is "never wrong" and would only surface in the classroom under certain conditions (such as when learners are at their best behaviour, when learners are struggling). The flipside is also true for participants (such as no shouting at learners in the puppets' presence).

Participants' expectations before their lesson began included: *"I was really curious to see how my learners would react to the puppets. But in all honesty, I was also a bit afraid of making a big mistake or not reaching the learners. I also knew that I could relax if I did make a mistake because my learners know that if I do make mistakes in class we all laugh together and continue teaching and fix our mistakes"* [P1:3]. Since participants' teaching-learning through a PoP (puppetry), hinged on being an artist (giving a lesson through drama [Hackling et al., 2011; Quintero, 2011]), two participants (males) expected the following: *"I didn't think I will be able to do it. Primarily due to my kind of personality. I expected that the learners would not participate or cooperate during the lesson. Learners would be more distracted by my gender (being a male) and teaching through puppetry"* [P3:3; P6:3]. Expectations like these might have allowed participants to feel "stereotyped" as it might be regarded as "weird" for male teachers to teach (with puppets) as it is perceived as such by society (Verdev, 2016) – hence creating a doorway for scepticism about the

implementation of a PoP (puppetry). Participants also had various ideas that they planned to integrate: *“I had all of these wonderful ideas, funny jokes and voices. I couldn’t stop thinking about how the kids would react. I imagined myself being brave and very funny in front of the class. I was thinking of a lot of gimmicks that I could use for my puppet”* [P8:3; P3:3]. These experiences may have allowed them to lay bare their perceptions of the course of the lesson. From these experiences, it can be mentioned that participants were optimistic in their presentation of the lesson, supporting a positive teaching-learning classroom climate, which may lead to increased motivation by learners to engage more in depth with the work at hand (Evans et al., 2009).

Participants commented on the enjoyable experiences and what they thought their learners had found most enjoyable and what surprised them (participants) during the presentation of their lessons. In Figure 5.1, I listed codes and indicated where evidence in the data could be found.

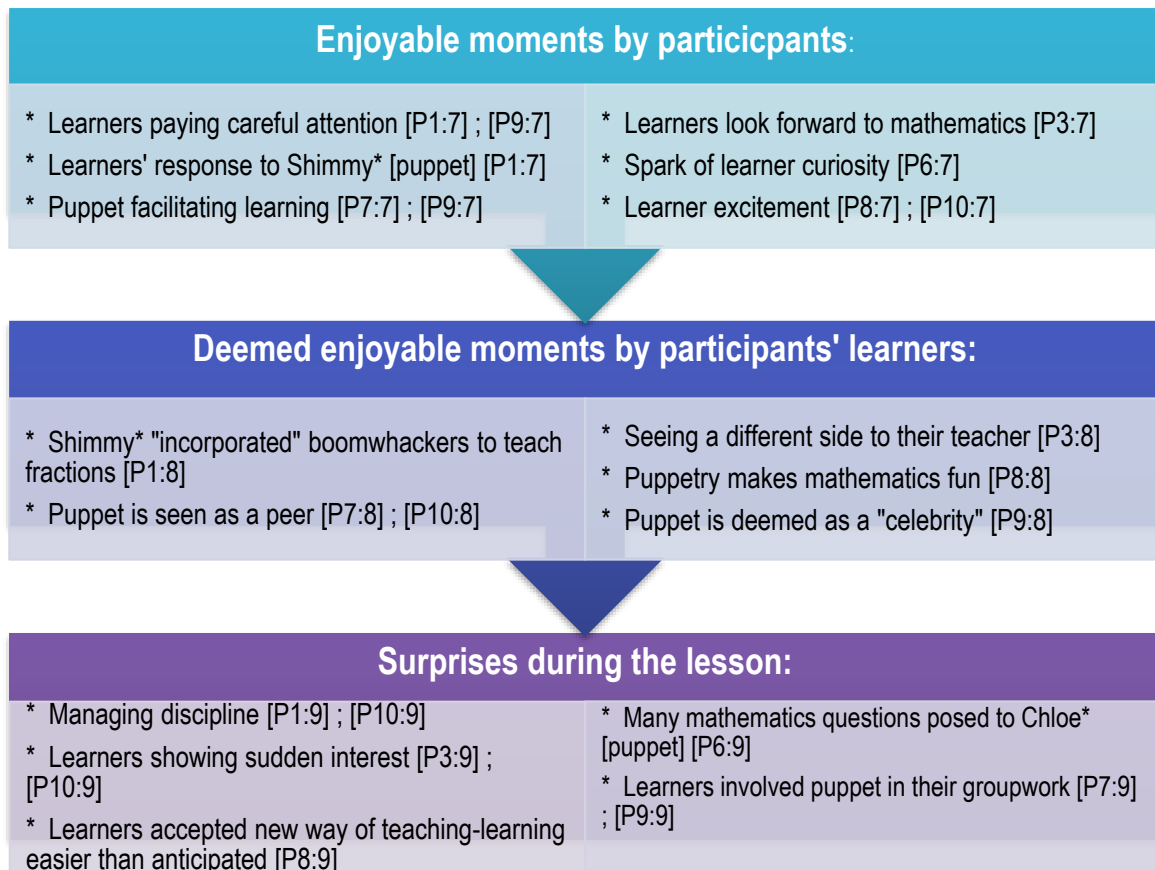


Figure 5.1: Enjoyable moments during teaching-learning with puppetry in the intermediate phase mathematics classroom

From these experiences noted by participants (Figure 5.1), it seemed as if both teacher and learner enjoyed the integration of puppetry and puppetry allowed for an element of surprise (e.g. improved behaviour, attention, cooperation) to emerge, as also mentioned in studies conducted by Keogh et al. (2008); Korošec (2012) and Remer and Tzuriel (2015). These experiences as mentioned by participants relate to multiple intelligence theory (Gardner, 1993) as well, since the

enjoyable moments by participants and their learners involved various talents and skills such as linguistic intelligence – *“learners’ response to Shimmy* [puppet]”* [P1:7] and intrapersonal intelligence – *“puppetry makes mathematics fun”* [P8:8]. Therefore, puppetry can be viewed as an inclusive teaching-learning strategy for the participant schools, since it accommodates various teaching and learning styles (although no hearing or visually impaired learners were present during data collection), transforming the intermediate phase mathematics classroom to a positive learning environment (Keogh et al., 2008).

Upon reflection on what participants liked least about their lessons regarding their integration of a PoP (puppetry), they noted that *“when the learners start misbehaving, the transition of two personalities was the worst. Having to come from a very fun personality to a strict one was so difficult”* [P3:10; P7:10; P9:10]. Participants took a step back and looked at the “bigger picture” with regard to the evaluation of their lesson with a PoP (puppetry). Evaluation of teaching-learning outcomes, as underpinned by metacognitive awareness, possibly acts as a driving force where participants identify tensions like these, which pertains to their self-directedness, to improve on future teaching-learning endeavours (Knowles, 1975; Shetty, 2014). The aspects participants liked least about teaching-learning with puppetry may all be linked to inexperience with the pedagogical applicability of puppetry. This may be overcome if puppetry is used more frequently in future, since through practise, the inexperienced but enthusiastic puppeteer (teacher) could improve his or her teaching-learning with puppetry, becoming skilful in the art of puppetry (Hughes, 2014; Smith, 1979).

When participants responded to the impact of this experience of PoP (puppetry) on future endeavours in teaching-learning, they responded as follows: *“puppetry will hopefully remain a large aspect of the lessons I present, as learners respond well and have a positive anticipation for lessons with puppetry. Using the puppets creates a sense of introspection and reliance on critical and creative thinking that is beneficial to making more meaningful lessons in mathematics”* [P1:15; P3:15; P7:15; P9:15]. These participants responded very eagerly towards the future re-implementation of puppetry, possibly indicating their willingness to continue to implement a new pedagogy that may enhance their teaching-learning (this was the object [TGC] of the intervention). It can be noted that the participants deemed puppetry to be a successful pedagogical tool, which allowed for a different (and fun) approach to teaching-learning intermediate phase mathematics (Kröger & Nupponen, 2019).

5.4 Synthesis of secondary research question 4

Participants' experiences with a PoP allowed them to mention how the utilisation of a PoP (puppetry) was considered as successful. Despite the challenges faced by participants (such as switching between the puppet and the teacher), they were still positive and optimistic about the implementation of a PoP (puppetry) for the intermediate phase mathematics classroom and that it may be introduced *"to learners in previous Grades to create a foundation on which can then later be built upon in Grades to follow"* [P8:15]. Hence participants deemed a PoP (puppetry) as an appropriate pedagogical tool with various benefits (see Figure 5.1) that enriched learners' overall teaching-learning experience in the intermediate phase mathematics classroom.

5.5 Secondary research question 5: What are intermediate phase mathematics teachers' lived experiences of the transfer of metacognitive awareness after the intervention?

As soon as participants started to link metacognitive awareness to their teaching-learning praxis, they mentioned that they were *"very conscious about my [their] teaching"* [P1:18-19]. The fact that participants were more aware of their teaching-learning practice, might have allowed them (teachers and learners) to create doorways for becoming expert teachers and learners (Ertmer & Newby, 1996). Increased awareness of *"how, why and what"* participants taught led to increased metacognitive awareness of *"the pictures, the drawings I use and how I teach and even though that slightest, small change made a change in my classes' discipline"* [P1:20-23].

Participants were prompted to reflect on the most important fact or idea they had learned during their lesson with a PoP (puppetry), and they responded that *"learners showed great interest as they have never been exposed to the such teaching practices"* [P1:4; P3:4]. Participants also noted that *"teachers can also be barriers to learning. Therefore, it is of importance for teaching to analyse their teaching prior, during and after lessons. In that case diagnosis can take place to allow for tracking of problems which can then be solved [remediation]"* [P3:4; P6:4]. The fact that participants acknowledged that they themselves may be barriers to their learners' learning, relates to metacognitive knowledge concerning person and task, where they, too, realise their own limitations in their respective mathematics classrooms.

Participants were prompted to reflect after they had taught their lessons with a PoP (puppetry), and it was interesting to note aware they had become of their teaching-learning praxis after the semi-structured open-ended interviews that focused their reflection on their perceptions of their teaching-learning before and during the intervention (see §§ 4.3.1 and 4.5.1). Metacognitive knowledge of the person, task and strategies emerged when participants mentioned that *"learners*

learn through insightful action and creativity due to their different levels of cognitive ability. I need to clearly distinguish my role from the puppet and create a setting that has a meaning and purpose for the puppet." [P9:4; P8:5]. Responses like these illustrate that participants not only reflected on the learner as a "person", but also on themselves (as a "person") in their own teaching-learning praxis. Hence person(al) knowledge of metacognitive knowledge may be considered by participants as being twofold, which depends on how critical their reflection was (Ertmer & Newby, 1996).

Metacognitive knowledge of the person (teacher in this case) also allowed for a tension [TGC] to emerge. Two participants in particular mentioned that *"I [they] used my [their] own voice, but it was confusing, because when is it the puppet and when is it my [their] voice?"* [P8:5; P9:5]. Although the teaching-learning experience was not what these participant initially planned it to be (with regard to the implementation of PoP [puppetry]), they were still able to voice these issues, which they might adapt for future teaching-learning endeavours. This experience might have served as a valuable "learning curve" on how to adapt and try new strategies, like a PoP (puppetry), even if they are not in their nature (teachers as artists – TGC).

Metacognitive knowledge of the person and task also emerged as being twofold by nature. Participants reported how learners perceived teaching-learning with a PoP (puppetry) during their lesson and how they *"responded very eagerly towards the puppet. They were more relax and showed a vulnerable side of them by asking the puppet 'How?' or 'please explain again'. They normally just keep quiet if they are sure"* [P7:4]. Participants' learners were eager to engage with the task (as assisted by the puppet). Participants referring to the puppet may also entail strategy knowledge, since teaching-learning with puppets can be viewed as a strategy.

Participants further noted how the task (to teach and learn with a PoP – puppetry) allowed for struggles and frustrations during the planning (accounted for later in this chapter) as well as presenting their lessons. These struggles and frustrations act as tensions [TGC], which could possibly dampen the implementation of a PoP for participants, or even other teachers in the future. In Figure 5.2, I listed codes and indicated where evidence in the data could be found to ease the flow of the overall dissertation.

Struggles and frustrations

• Struggles in presentation of a lesson concerning PoP (puppetry):

- * Learner behaviour [P1:12] ; [P7:12]
- * Transitioning between two personalities [P3:12] ; [P9:12]
- * Transferring knowledge through storytelling [P6:12]
- * Voicing puppet correctly [P8:12]
- * Handling the puppet [P10:12]

Frustrations in presenting of a lesson concerning PoP (puppetry):

- * Staying in tune with the puppet whilst teaching [P1:14] ; [P8:14]
- * Learner misbehaviour [P3:14] ; [P7:14]
- * Learner comments not pertaining to the lesson [P6:14] ; [P9:14]

Figure 5.2: Presentation of struggles and frustrations during lesson presentation as experienced by participants where metacognitive awareness surfaced

The struggles faced in the presentation of a lesson (Figure 5.2) on PoP (puppetry) correspond with findings by Hackling et al. (2011) and Simon et al. (2008). Learner behaviour can be improved over a period of time when exposed to learning with a puppet. According to Hackling et al. (2011), not all teachers benefit from using a PoP (puppetry) in their classrooms, since, if they are not confident to utilise the puppets (teachers as artists – TGC), difficulties can occur (such as transition between teacher and puppet and the development of personalities and gimmicks for the puppets). Although I do not perceive the participants as having a lack of confidence, these difficulties they faced could be due to inexperience with teaching with a PoP (puppetry).

The frustrations participants faced such as “... *emphasis on ensuring the puppet is present and not emphasising the goal and message the puppet is set to deliver*” [P9:13] in planning a lesson on a PoP (puppetry) could be due to little or no exposure to artistic education as script writing and performing a “play” form part of artistic education (Hamre, 2012). One of the frustrations reported by participants was that learner misbehaviour still surfaced and that “... *having to come from a very fun personality [teaching with the puppet] to a strict one [disciplining the class during the lesson] was difficult*” [P3:10]. According to Remer and Tzuriel (2015), puppets do not have a direct influence on learner misbehaviour, but they can take on a monitoring role, decreasing disruptions.

Metacognitive knowledge of teaching-learning strategies also emerged as twofold by nature. Participants planned to equip learners with strategies in order to assist the puppet to reach his or her teaching-learning goal: “*They wanted to help Bokkie* [puppet] they were more concerned about Bokkie* reaching his goal*” [P10:4]. This complements the participants’ teaching-learning strategies, since their strategy to teach via a PoP (puppetry) allowed for improved learner engagement: “... *more learners wanted to participate during the lesson*” [P10:4; P8:4]. A teaching-

learning strategy concerning a PoP (puppetry) also allowed for tensions [TGC] to surface. One participant mentioned that *“you can prepare as much as you like, have many expectations as you want, but nothing prepares you for the way learners react when they are introduced to the puppet – which they are not used to seeing in Mathematics”* [P8:4]. Responses like these may indicate that participants were new to implementing a PoP (puppetry) as teaching-learning strategy and that it was not an easy task, but since it was a first attempt, participants reflected overall that it was a strategy to get used to.

Planning

Participants were prompted to reflect on self-regulation as well, which surfaced regularly in their responses. Regarding the planning aspect of self-regulation under the broader umbrella of metacognitive awareness (refer to Figure 5.1), participants faced various struggles and frustrations regarding PoP (puppetry) during the planning phase of their lessons. Although participants planned their lessons during the adapted lesson study workshop of the intervention, the following responses might indicate that they refined it further after the intervention, since these issues were not raised in this manner during the intervention. In Figure 5.3, I listed codes and indicated where evidence in the data could be found relating to struggles and frustrations during lesson planning as experienced by participants.

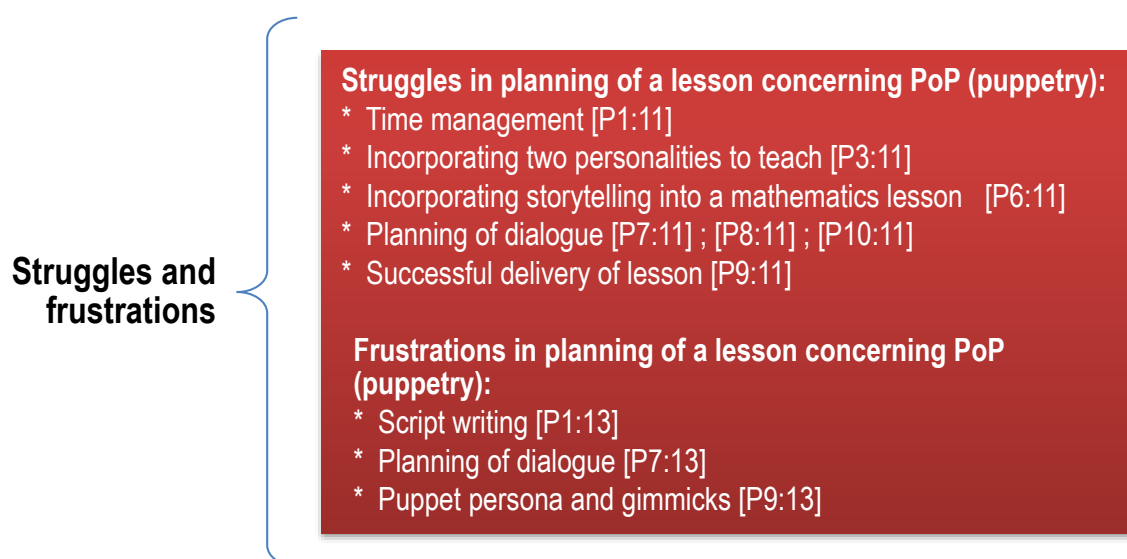


Figure 5.3: Presentation of struggles and frustrations during lesson planning as experienced by participants where metacognitive awareness surfaced

These struggles and frustrations (Figure 5.3) experienced by participants might indicate that there is a need for an intervention over an extended period of time, allowing participants with more opportunities for teaching-learning through a PoP (puppetry) with more support. For the purpose of this study, and as indicated by participants, two workshops as part of the intervention were regarded as appropriate as an introduction, since it was all that they could handle at that stage

due to their role overall (teaching and administrations responsibilities) at their respective schools. These struggles and frustrations might also instil design principles for future research endeavours.

Monitoring

Relating to monitoring as part of self-regulation, participants noticed that their learners *“didn’t give others a chance during the group work session”* [P7:5]. Participants deemed this as a positive indicator of teaching-learning in mathematics, since *“all the learners were actively involved in the lesson and they were able to assist and correct their mistakes with the help of each other”* [P7:5; P1:5; P9:5; P10:4]. Active involvement may account for “expert learners”, concurring with the study done by Ertmer and Newby (1996), where teaching-learning with a PoP (puppetry), overall, allowed for *“not only promoting mathematical knowledge, but also valuable communicating and listening skills interacting with peers”* [P7:5], enriching the teaching-learning experience for learners in the intermediate phase mathematics classroom.

While participants were presenting their lessons and monitored the phases of their lessons, they also noted that *“learners find visual (puppets) very interesting, extending learner concentration span, because they are not used to that teaching practice* [teaching-learning with a PoP – puppetry]” [P3:5]. These responses might allow for the possible re-integration of a PoP (puppetry) in future teaching-learning endeavours as both teacher and learner find teaching-learning through puppetry to be beneficial by nature, since it is not a strategy that learners are used to.

Evaluation

Participants reflected even more on evaluation after the lesson and said they were able to *“dot down what worked and what did not work, so that I [they] could make changes”* [P1:5; P9:5]. These responses might be an indication of participants’ metacognitive awareness, showing that they were more aware after the intervention to implement their own teaching-learning strategies regarding effective and non-effective approaches with a PoP (puppetry). This indicated that they might use puppetry again for future teaching-learning endeavours. Participants also allowed for their learners to reflect, since *“I [they] did reflection in the class by asking the learners some questions”* [P1:5; P9:5], which could possibly indicate that they realised the importance of metacognitive awareness in mathematics for their learners as well, instilling in them (learners) a more critical awareness of how, what and why they do certain things in mathematics in a certain way.

By applying a PoP (puppetry), participants also indicated that *“learning took place faster than usual and learners’ responses were better”* [P10:4] and *“after the lesson with the puppet I [they] felt a bit of relief, knowing that I [they] had meet the outcomes of my lesson faster than usual”*

[P10:5]. This might be due to the various advantages puppetry pose, as was found by Kröger and Nupponen (2019) (see Chapter 2, § 2.3.5.1. to 2.5.3.5), since it enhances the overall teaching-learning experience for learners, allowing for a positive classroom environment conducive for optimal learning (Sulaiman, 2015). Participants were also able to evaluate the overall implementation of a PoP (puppetry) and it surfaced that they distilled goals for future teaching-learning endeavours such as *“writing scripts for more (different) topics; exploring story writing as part of scripts and building on that as part of puppetry”* [P1:6; P8:6; P9:6; P10:6]. The fact that participants were able to identify how teaching-learning with puppets would impact upon future endeavours allowed them to identify areas for self-improvement. According to Erskine (2010) and Williamson and Paulsen-Becejac (2018), self-improvement in praxis is the essence of SDL and reflection, which promotes self-directedness, ensuring that participants become autonomous in transferring the knowledge gained in the intervention to their respective mathematics classrooms.

5.6 Synthesis of research question 5

Regarding this sub-research question, participants noticed the importance of reflection on planning, monitoring and evaluating their lessons with regard to the person (learners), the task, and teaching and learning strategies. They were therefore able to identify their own as well as learners’ teaching-learning needs. Participants’ metacognition may allow for a foundation for future endeavours in teaching-learning with puppetry and make them aware of changes to incorporate puppets for a more fluent lesson. Participants’ experiences with a PoP (puppetry) may lead them to shift from facilitators to agents of change – teaching-learning with new strategies to make mathematics more applicable to learners in various contexts. Metacognitive awareness and the transfer thereof to participants’ respective intermediate phase mathematics classrooms allowed for SDL characteristics (Knowles, 1975) to surface, possibly highlighting that the participants had a willingness to improve their teaching-learning praxis overall to the benefit of the learners whom they taught.

5.7 Overall interpretation and results of the intervention

Participants experienced the intervention as a positive overall, since *“[i]t was very supportive. We really learned from each other; we could ask anytime”* [P7:101-104]. It was also interesting to note that the support material given to participants (intervention booklet) was deemed as very helpful: *“I see myself using these resources 10 years from now..., uhm..., 20 years later. They are that resourceful. It keeps the whole life-long learning idea that we should have”* [P9:105-107]. The fact that this participant mentioned lifelong learning could imply that he might teach with a PoP (puppetry) for years to come, and that this autonomy in his teaching-learning assisted him

to find the intervention as an overall capacity to invest in his innovation [R&G] for future teaching-learning endeavours. Lifelong learning and autonomy in teaching-learning praxis is once again a firm foundation of SDL, concurring with Knowles (1975).

The intervention (as capacity to support innovation – R&G) acted as a tool [TGC] to empower intermediate phase mathematics teachers. Participants were prompted to reflect on contributions the intervention made towards their overall experience of teaching-learning with a PoP (puppetry), and they mentioned that they *“appreciated the opportunity and hope that many more schools incorporate this to teaching in classrooms across all subjects”* [P1:16; P3:16]. Another participant also mentioned that *“puppetry has enabled me to see benefits in play as a pedagogy and filling gaps of meaning that occur during teaching. The puppets are useful for both teacher and learner and a great way to strength interest for learning. Puppetry and metacognition enhance their thinking skills but also dismantles the usual distractions that take up teaching time. By having the puppet as a guide and an active participant through any lesson the teaching becomes more concrete and memorable”* [P9:16; P10:16]. Participants’ responses showed that their whole experience in teaching-learning with a PoP (puppetry) as educational (pedagogical) tool provided them with a rich experience and made them aware of their new knowledge by transferring it to their own praxis and respective classrooms.

From these results of the intervention, it can be said that peer participants and mediatory resources (intervention booklet) as well as other resources (CAPS, lesson planning templates and textbooks as rules) could be seen as advantageous to each of these participants during this intervention. These factors acted as support and encouragement from which participants could benefit, since teachers tend to lose their self-confidence when faced with a situation where new strategies for teaching-learning needs to be employed (Fani & Ghaemi, 2011).

The professional development that participants acquired during (and after) this study, as based on Warford’s (2011) ZPTD, allowed for the last stage (recursion stage) to emerge when they completed their reflection journals. Table 4.3 is cited here but includes the recursion stage to see “the bigger picture” regarding how participants developed (perceptions to lived experiences).

Table 5.4 (4.3): Participant professional development pertaining to the ZPTD and intervention

ZPTD stages (Fani & Ghaemi, 2011; Warford, 2011)	Data collection instruments used before during and after the intervention	Description and explanation
Self-assistance stage	Semi-structured open-ended individual interviews	The input they had given in these interviews was based on prior experiences with and beliefs of teaching-learning of intermediate phase mathematics. The self-assistance stage was used as point of departure of participants' actual level of development in regard to metacognition and PoP (puppetry).
Expert other assistance stage	Reflective prompts	Participants' knowledge was deepened, activating improved reflection on their teaching-learning praxis, while sharing it with knowledgeable others. Therefore, these participants can be deemed as reflective practitioners. Reflective practitioners are merely one of the teaching factors that are part of their array of strategies in their division of labour in order to teach their intermediate phase mathematics learners in a meaningful way.
Internalisation stage	Observations	Participants' application of newly attained knowledge for demonstration purposes where the intervention allowed for a practice situation, leading to internal growth of participants' teaching-learning praxis. This stage informed participants as to how they were going to apply PoP (puppetry) in their classrooms and when by consulting peers and collaborating with us as facilitators (expert others).
Recursion stage	Post-focus group interview and reflective journals	During the recursion stage, participants had another opportunity to engage with a PoP (puppetry), allowing for a smoother utilisation of their newly gained knowledge, although participants felt at times that it was difficult and acknowledged that they needed more practise. This stage allowed for all the newly gained knowledge obtained, developed and integrated by participants to "come together".

(adapted from Fani & Ghaemi, 2011; Warford, 2011)

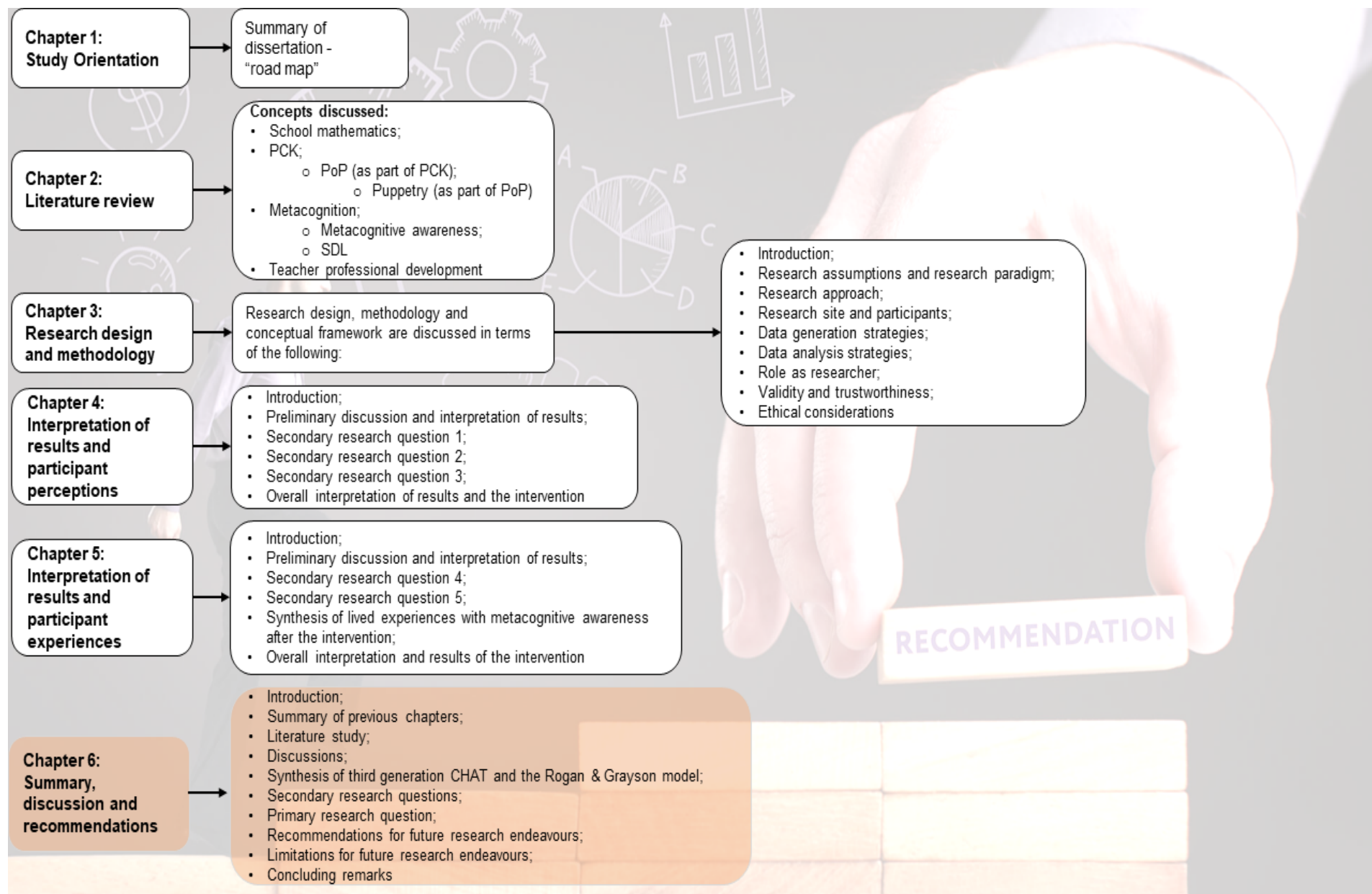
In Table 5.4, it seems as if participants had shown growth (in their overall PCK) since before, during and after the intervention, as supported by the ZPTD. This indicates that participants (being knowledgeable in their field of teaching-learning) developed potentially (proximal development) as they had obtained valuable teaching-learning insights during the intervention, allowing them to integrate this new knowledge with their existing praxis, leading to actual application in their respective intermediate phase mathematics classrooms.

Participants' experiences after the intervention, reflects growth which might implicate that the quality of the intervention impacted positively on their metacognitive awareness pertaining to a PoP [puppetry] which they transferred in their respective classrooms (Tang, et al. 2016).

5.8 Chapter summary

In this chapter, I reported as clearly and accurately as possible on secondary research questions four and five. Chapter 6 concerns third-generation CHAT and the Rogan and Grayson model which will be integrated as research lenses to enhance our understanding of tensions that emerged in this study as well as the summary, discussions, limitations and recommendations.

“It always seems impossible until it’s done” (Nelson Mandela)



CHAPTER 6: SUMMARY, DISCUSSION AND RECOMMENDATIONS

6.1 Introduction

In Chapters 4 and 5, the data that emerged from this study were presented and interpreted.

A summary and discussion of the study are subsequently provided and recommendations for future research are made.

6.2 Summary of previous chapters

This study was a generic qualitative study with elements of phenomenology. According to Creswell (2014), in qualitative research, participants to attach meaning to their experiences in light of their personal worldview. Therefore, a generic qualitative study was regarded as appropriate as the aim was to capture participants' lived experiences. Elements of phenomenology in this study allowed me to delve into participants' perceptions (understanding and feelings) as well as their experiences of a PoP (puppetry) and to develop their metacognitive awareness. A study of this nature allowed for a more open-ended approach where participants could share more in-depth detail about their overall experience.

Chapter 1 served as a roadmap for this study. The rationale and purpose statement were provided in this chapter. The research questions were established, allowing for an overall aim to emerge. The theoretical framework (based on social constructivism) allowed me to identify two lenses to analyse the data, namely the third-generation CHAT (Engeström, 1987) and the Rogan and Grayson model (Rogan & Grayson, 2003). The theoretical framework and research lenses stemmed from the paradigmatic perspective (interpretivist by nature). The premises of the above-mentioned elements informed the intervention as well as the data collection instruments employed in this study.

Chapter 2 provided information on previous research done on school mathematics, PCK, and SMK, which is underlying to MKT, PoP, puppetry, multiple intelligences, metacognition, SDL and teacher professional development (across the ZPTD). All of these concepts played a vital role in distinguishing the need for professional development on metacognitive awareness to enable participants to transfer a PoP (puppetry) meaningfully to an intermediate phase mathematics classroom.

In Chapter 3, the interconnectedness of the research design, methodology and conceptual framework are discussed. This allowed for the different phases of the data generation

strategies to be implemented in order to answer the primary and secondary research questions. The research assumptions and paradigm allowed for a general philosophical view to emerge, allowing me to understand how participants experienced this study overall. The two research lenses – third-generation CHAT (Engeström, 1987) and the Rogan and Grayson model (Rogan & Grayson, 2003) – were described in more detail as to how they were incorporated into this study. The research site and participants were discussed in detail to gain an understanding of where participants came from (context) and how they were selected. Data generation strategies were discussed and the unfolding of the phases of the data collection before, during and after the intervention were outlined. My role as researcher was described for each of these phases. Trustworthiness and validity in this study were discussed, followed by the ethical considerations applicable to this study – such as voluntary participation, potential risks and benefits, and privacy and confidentiality.

Chapter 4 presented the findings on participants' perceptions and experiences before and during the intervention with a PoP (puppetry) relating to their overall metacognition (metacognitive awareness). The interpretation of the results of secondary research questions one to three that emerged were integrated.

Chapter 5 presented the findings on participants' experiences and transfer of knowledge of a PoP (puppetry) and metacognitive awareness after the intervention. The interpretation of the results of secondary research questions four and five that emerged were integrated.

Next, I summarise the main findings of the secondary research questions to ultimately answer the primary research question while integrating the two research lenses, namely third-generation CHAT and Rogan and Grayson model. Recommendations are made, which may inform future research on metacognition and PoP (puppetry), and the limitations of this study are highlighted.

6.3 Literature study

The literature study (Chapter 2) was conducted prior, during and after data collection due to the emerging nature of this study. This study commenced in 2017 and lasted until 2019. In search of literature, the conceptual and theoretical frameworks were employed as departure points of this study. The literature for this study was published by pioneers in the field (as early as 1975) and literature up until 2019 was included. The literature gave insight into the consistency of research endeavours in the field over five decades. Pioneer resources were combined with the more recent literature to make detailed comparisons between literature and the findings that emerged from this study.

6.4 Discussions

In the following subsections, the findings that emerged allow me to implement third-generation CHAT (and the Rogan and Grayson model pertaining to context), to highlight the tensions (positive and negative), which emerged in this study. The literature informs the discussions on the findings (albeit contradictory by nature). Table 6.1 provides a synthesis of the secondary questions, relevant literature and the research findings. Reference is also made to the relevant subsections in which these findings are discussed.

Table 6.1: Synthesis of qualitative findings based on secondary research questions

Secondary research questions	Literature in accordance with findings	Relevant sub-sections in Chapters 4 and 5
<u>Secondary research question 1:</u> What are intermediate phase mathematics teachers' perceptions of pedagogies of play (puppetry) before and during the intervention?	Wilson (n.d.); Engeström (1987); Gardner (1993); Rogan & Grayson (2003); Farné (2005); Veenman et al. (2006); Hacker et al. (2009); DoE, (2011); Hackling et al. (2011); Korošec, (2012); Gobec (2012); OECD (2012); Baumer (2013); Thompson (2013); Ramnarain & Shuster (2014); Remer & Tzuriel (2015); Brits et al. (2016); Girvan (2016); Sabna and Hameed (2016); Whiteland (2016); Acharya (2017); Kröger & Nupponen (2019)	4.3.1. 4.3.2. 4.4.
<u>Secondary research question 2:</u> What are intermediate phase mathematics teachers' perceptions of metacognitive awareness before and after the intervention?	Flavell (1979); Engeström (1987); Ertmer & Newby (1996); Rogan & Grayson (2003); DoE (2011); Zumbunn et al. (2011); Gravett & De Beer (2015) Crescenzi (2016)	4.5. 4.5.1. 4.5.2. 4.6.
<u>Secondary research question 3:</u> How do intermediate phase mathematics teachers prepare lesson plans and puppetry scripts to implement in their classrooms before and during the intervention?	Knowles (1975); Engeström (1987); Rogan & Grayson (2003); Suffolk (2007); Hill et al. (2008); Kirsh (2010); DoE (2011); OECD (2012); Macmillan Education South Africa (2018); Singh (2018); Msimanga (2019)	4.7. 4.8.
<u>Secondary research question 4:</u> What are intermediate phase mathematics teachers' lived experiences of the transfer of pedagogies of play (puppetry) after the intervention?	Smith (1979); Engeström (1987); Gardner (1993); Rogan & Grayson (2003); Keogh et al. (2008); Evans et al. (2009); Hackling et al. (2011); Quintero (2011); Korošec (2012); Ahlcrona (2012); Hughes (2014); Shetty (2014); Remer & Tzuriel (2015); Maharani (2016); Verdev (2016); Kröger & Nupponen (2019)	5.3.
<u>Secondary research question 5:</u> What are intermediate phase mathematics teachers' lived experiences of the transfer of metacognitive awareness after the intervention?	Knowles (1975); Engeström (1987); Ertmer & Newby (1996); Rogan & Grayson (2003); Simon et al. (2008); Erskine (2010); Hackling et al. (2011); Hamre (2012); Remer & Tzuriel (2015); Sulaiman (2015); Williamson & Paulsen-Becejac (2018); Kröger & Nupponen (2019)	5.5. 5.6.

(adapted from Jagals, 2013)

Table 6.1 illustrates the importance of the body of scholarship to this study and how literature was integrated to answer the secondary research questions (see § 4.4, 4.6, 4.8, 5.4, 5.6 and 6.5). The answers to the secondary research questions assist me to answer the primary research question in this chapter (§ 6.7). In the next section, a synthesis is provided as to how the relevant literature was used together with the two research lenses (third-generation CHAT and the Rogan and Grayson model) to bind this study together.

6.5 Synthesis of third-generation CHAT and the Rogan and Grayson model

The third-generation CHAT (Engeström, 1987) (see Chapter 3, § 3.2.2.1) and the Rogan and Grayson model (2003) (see § 3.2.2.2) were employed as research lenses in this study. Since third-generation CHAT allowed for the juxtaposing with two activity systems – (i) participant perceptions during the intervention (see Chapter 3, § 3.2.2.1) and (ii) participant experiences after the intervention (see Chapter 3, § 3.2.2.1) – the object (outcome) of both of these activity systems were enhanced metacognitive awareness and improved teaching-learning with a PoP (puppetry). Participants (subjects) worked towards (and achieve) the outcome during (and after) the intervention and some tensions (positive and negative) arose, which might have influenced and contributed to the participants (subjects) in reaching the outcome.

Table 6.2: Synthesis of tensions (positive and negative) utilising third-generation CHAT

Activity systems	Positive tensions according to participants	Negative tensions according to participants	Brief discussion on tensions
Tensions between the tools and the subject			
Activity system 1: (Before and during)	* Participants were very optimistic about the implementation of a PoP [puppetry] as it might enhance their overall teaching-learning	* they mentioned that the language of teaching-learning was not necessarily their learners' home language; * Township and rural schools were often underresourced,	* Although participants were very curious and eager towards the implementation of a PoP [puppetry], language barriers to teaching-learning were one of the issues raised as participants struggled in making mathematics understandable and meaningful, as learners struggled as it were not presented in their home languages and participants were doubtful whether puppetry could really enhance the learners' understanding
Activity system 2: (After)	* Participants received puppets for their classrooms to implement a PoP; * Professional development of participants allowed them to utilise puppets and write puppetry scripts using the intervention booklet		* The participants (subjects) modelled good teaching-learning praxis, since they were able to determine their own strengths and weaknesses pertaining to a tool , such as PoP (puppetry), before, during and after the intervention, allowing for metacognitive awareness to surface based on their reflections on their respective teaching-learning praxes.
Tensions between the subject and the object			
Activity system 1: (Before and during)		* Scepticism in implementing a PoP (puppetry) as learners might perceive it as a "joke" * One puppet in an underresourced classroom might not be enough	* Since participants were afforded one puppet respectively (tools), it may have influenced how they reflected on reaching their object (outcome), since the same puppet (tool) might not have impacted learners if used in the long term (see Chapter 4, Table 4.5 – Gobec, 2012).
Activity system 2: (After)	* Intervention and metacognitive awareness assisted participants in successful realization of the object		* Participants were able to report on the success of the implementation of a PoP [puppetry], as it had an overall positive impact on their teaching-learning. Metacognitive awareness enabled participants to reflect on this experience and complete their reflective journals as proof of their implementation.

Table 6.2: Synthesis of tensions (positive and negative) utilising third-generation CHAT

Tensions between the subject and the rules			
Activity system 1: (Before and during)		* Participants do not view themselves necessarily as artists; * Accommodating multiple intelligences is difficult as participants are not aware thereof; * Awareness of the tenets of mathematics, as participants have a naïve understanding thereof; * Guidelines for script writing was confusing, as participants were not sure as to the writing of a story or a script in dialogue format between themselves and their puppets; * Mathematisation of puppetry scripts was difficult, because participants were unsure how to embed mathematical principles in the script; * Learner discipline issues as learners could make fun of the teacher or puppet; * Examination/performance-driven schooling system implicating little time to implement different teaching-learning pedagogies (such as a PoP [puppetry]); * Multigrade teaching as it posed lesson planning challenges upon integration of a PoP [puppetry]; * Socio-economic issues as many learners in the rural and township context stem from poor households, hence alcohol syndrome causes issues pertaining to learners' concentration span in the mathematics classroom	* Participants (subjects) had difficulty with rules such as CAPS (DoE, 2011), pace setters, which might not have allowed for enough and sufficient time for the implementation of PoP (puppetry). The re-implementation of a PoP (puppetry) might also be troublesome, since lesson planning and writing a script in order to integrate the puppet is time consuming; * The rules (such as lesson planning; CAPS [DoE, 2011]; pace setters; tenets of school mathematics) may all be overwhelming for participants to adhere to as well as to integrate a PoP (puppetry), since the school community (principal; peer teachers; learners; surrounding school community) is nested in an examination-driven system where results must be accounted for, which may hinder the re-implementation of a PoP (puppetry), since it may be deemed as futile (or "playing around") by other role players (principals or parents) because it is uncommon in especially the mathematics classroom.
Activity system 2: (After)	* The rules (such as CAPS, textbooks, guidelines for implementation of PoP) assisted to guide participants during and after the intervention in order for participants to act as agents of change;		* The rules allowed participants to implement a PoP (puppetry) in the context of the community, making learning understandable, meaningful and accessible

Table 6.2: Synthesis of tensions (positive and negative) utilising third-generation CHAT

Tensions between the community and division of labour			
Activity system 1: (Before and during)		* Teacher as facilitator of learning since they were metacognitively more aware of how they taught and why; * Teacher as artist where they integrated an art form (puppetry) in the teaching-learning of mathematics; * Teacher as agent of change	* Despite the challenges the community may pose (as mentioned in the discussion above), participants still need to act as agents of change where (despite these challenges) they still implement (and re-implement) – division of labour – a PoP (puppetry), since it is viewed as making intermediate phase mathematics fun, accessible and meaningful for learners
Activity system 2: (After)	* The community might have inspired participants to act reflective and adapt and mathematise their lessons in order to be aligned with the context of the school and surrounding community		* Participants mathematised the content and integrated it into their lessons based on the context of their school and learners, making mathematics relevant to their learners' real-life contexts.
Tensions between division of labour and the object			
Activity system 1: (Before and during)		* Long-term sustainability of PoP * Stereotyping of specifically male teachers teaching-learning with puppets	* Participants questioned the long-term implementation of a PoP [puppetry] and whether it will still have an effect on teaching-learning, fostering positive domains. Male participants were also curious as to whether teaching-learning with a puppet might be perceived as “weird” by learners, as it is unlikely for “males” to engage in such pedagogies.
Activity system 2: (After)	* Teachers as reflective practitioners allowed for a more effective object-oriented perspective, since they constantly regulated whether they were on track to reach the object or not		* For participants to apply a PoP (puppetry), they must be metacognitively aware of how, what and why they teach in a specific manner (division of labour) – this awareness allows for possible change in their respective teaching-learning praxes in order to improve thereupon, hence reaching the object (outcome) of transferring knowledge gained on a PoP (puppetry) to their respective classrooms
Tensions division of labour and the subject			
Activity system 1: (Before and during)		* Frustrations and difficulty to write puppetry scripts * Frustrated in teaching-learning with a PoP (puppetry)	* Since participants (subjects) had to implement a PoP (puppetry), they had to “put in the effort” (division of labour) – hence it is deemed as hard work to write a script for the puppets, integrate it with a lesson and mathematise it so that the puppet is a viable pedagogical tool for teaching-learning for intermediate phase learners. This may cause difficulty for future teaching-learning endeavours as it is time consuming to apply
Activity system 2: (After)	* Teachers as reflective practitioners integrated their current knowledge of their teaching-learning praxis in order to adapt and implement new knowledge of a PoP (puppetry)		* Participants were able to transfer what they have been empowered with during the intervention, to their classrooms in order to implement a PoP [puppetry] and reflect thereupon. This broadened their current teaching-learning praxis, as participants became more aware of other pedagogies to implement in their respective mathematics classrooms.

Table 6.3: Synthesis of tensions (positive and negative) utilising third-generation CHAT

Tensions between the rules and the object			
Activity system 1: (Before and during)		* Time constraints due to fixed schedule (CAPS) as pre-scribed by the DoEs (2011) pace setters	* The pace as set out in the CAPS to teach all content throughout the year, placed participants under pressure when experimenting with a different pedagogy such as a PoP [puppetry].
Activity system 2: (After)	* The rules served as a guideline to assist participants to stay in the parameters of teaching-learning as intermediate phase mathematics professionals and CAPS		* Rules such as puppetry script writing and applying puppetry in the intermediate phase mathematics classroom may have made participants more aware of their teaching-learning praxis, since they had to be aware of metacognitive knowledge (person, task and strategies) and self-regulation (planning, monitoring and evaluating) in order to successfully integrate a PoP (puppetry) for the purpose of reaching the object (outcome)
Tensions between the subject and the community			
Activity system 1: (Before and during)		* Peer pressure (non-participants)	* Non-participating colleagues at each participants' respective school may deem puppetry as inadequate, hence discouraging participants to re-implement it, since there is no "buy-in" from non-participating colleagues, as they did not have the professional development to support participants in their teaching-learning endeavours – therefore participants might not have a supportive community at their respective schools
Activity system 2: (After)	* Facilitators and peer participants at each school could have acted as support for participants' willingness implement a PoP (puppetry) in their respective classrooms		* Participants and peer participants (subjects) supported each other throughout the intervention and acted as a community of practice where they shared a common object (outcome), allowing for an improved realisation of the object (outcome)
Tensions between the community and the object			
Activity system 1: (Before and during)		* Participants are hesitant to ask facilitators for assistance	* Participants may be hesitant to ask facilitators for further assistance in future teaching-learning endeavours, which may also prohibit them (since their direct community at the school may not be supportive) to implement a PoP (puppetry), (object – outcome), hence they might revert to more a traditional teaching-learning praxis which they might have conducted before
Activity system 2: (After)	* The community could have acted as a community of praxis, supporting participants <i>en route</i> to reach the object successfully.	* Behavioural issues were reported, where some learners took the opportunity of misbehaving when they puppet is part of the lesson	* Participants engaged with their peers who took part in this study, hence motivating one another to teach their lessons while integrating a PoP [puppetry] and to share knowledge on what worked and did not work; * Behavioural issues were also reported where participants noted that they themselves, cannot shout at learners when the puppet is present, hence some of their learners took liberty of the situation misbehaviour emerged.

(adapted from Engeström, 1987)

In Table 6.2, numerous tensions (positive and negative) surfaced, which may influence future teaching-learning endeavours with regard to the implementation of a PoP (puppetry). There is, however, uncertainty as to the amount of possible tensions in third-generation CHAT (Beatty & Feldman, 2012). According to Beatty and Feldman (2012), the influence of professional development (intervention) on the participants (subject) is in constant conflict (tension) with the object (outcome – teaching-learning successfully with a PoP [puppetry], while being more metacognitively aware). The manner in which participants were metacognitively aware of how they contextualised lessons, were based on their school and the learners in their respective classrooms. hence the integration of the Rogan and Grayson model allowed me to interpret these tensions in the light of participants' school context.

Rogan and Grayson model

Since the integration of the Rogan and Grayson model focussed on the influence of context when implementing a PoP [puppetry] as new teaching-learning strategy in the intermediate phase mathematics classroom, the fact that the participants were from rural and township schools, allowed for a better understanding of how they progressed in their professional development before, during and after the intervention (including metacognitive awareness). Tensions (positive and negative) such as the following, emerging from the integration of third-generation CHAT in Table 6.2, can be interpreted as follows based on the Rogan and Grayson model.

- i. *Tensions between the tools and the subject:* As tensions stimulate change, participants are perceived as agents of change, hence allowing them to implement a different approach in the teaching-learning of intermediate phase mathematics, making mathematics understandable and meaningful for their learners in their context. It should be noted that the negative tensions (such as underresourced classrooms; scepticism to implement a PoP [puppetry]; participants as artists; and stereotyping of male teachers teaching-learning with a PoP) may be overcome (changed) with more exposure and training on an ongoing basis to teaching-learning with a PoP (puppetry) (Beatty & Feldman, 2012).

The negative tensions also allowed for development of participants to surface, possibly indicating that, although participants experienced these negative tensions, their empowerment through a PoP (puppetry) and metacognitive awareness enhanced their teaching-learning praxis (receiving puppets in an underresourced classroom; receiving professional development based on a PoP [puppetry] additionally during the year at no cost to willing participants; and transferring the knowledge of a PoP (puppetry) to

their teaching-learning praxis in order to “revive” fallen interest learners might have in intermediate phase mathematics) (Beatty & Feldman, 2012).

- ii. *Tensions between the subject and the rules:* Although participants were “governed” by rules such as the CAPS (DoE, 2011), they had the opportunity to use their school context and environment as point of departure and mathematise content (metacognitively aware of who their learners are and where they come from), in such a manner that learners will find it understandable and meaningful. The pressures placed on participants by elements such as pace setters and the examination-driven nature of school mathematics, allowed them to explore different pedagogies (PoP – [puppetry]), as a pedagogical tool to enhance their teaching-learning in their respective classrooms. This is indicative of participants’ willingness to improve their own teaching and enhance their learners’ overall learning, equipping them for demanding futures.
- iii. *Tensions between division of labour and the subject:* Participants found lesson planning pertaining to its embeddedness in puppetry scripts frustrating, as it entailed more detailed knowledge pertaining to their field (mathematising content and infusing it into puppetry scripts), as well as creative thinking (participants as artists), where they had to use drama to transfer the content to the learners. Although participants were sceptic about the planning involved, they were metacognitively aware of how their learners found teaching-learning through a PoP (puppetry), fun hence, increased classroom participation and meaningful teaching-learning occurred.
- iv. *Tensions between the community and the object:* Non-participating colleagues at the participating schools made the implementation of a PoP [puppetry] difficult for participants as they did not deem a PoP [puppetry] as something useful. Participants collaborated with their participating peers in order to share ideas (metacognitive awareness) on what worked and did not work when they presented their lessons to their respective classrooms, hence supporting each other in their teaching-learning endeavours and allowing the object to realize.

The knowledge that participants gained during the intervention were implemented in their specific school context. The Rogan and Grayson model indicates that the process of change (like the transfer and integration of PoP [puppetry] in the intermediate phase mathematics classroom) is different in every school because it is context-bound.

The integration of third-generation CHAT and the Rogan and Grayson model allowed me to potentially identify some of the main tensions, which might inform future teaching-learning and/or research endeavours on PoP (puppetry); metacognitive awareness and intermediate

phase mathematics and how it links to context. Based on these tensions, I could answer the secondary research questions to bind this research together with the primary research question. The following subsections are evidence of the powerful combination of these two research lenses in order for answers to emerge.

6.6 Secondary research questions

For the purpose of this study, five secondary research questions were identified. Each of these research questions resided in one or more of the data collection instruments employed in this study (see Chapter 4, Table 4.1). The accompanying overarching themes, subthemes, categories and codes for each secondary research question are summarised in Table 4.2.

6.6.1 What are intermediate phase mathematics teachers' perceptions of PoP (puppetry) before and during the intervention?

The findings indicated that the participant had not heard about the term PoP at all before this research. Findings also showed that the participants were optimistic to implement a new approach, since new approaches could enhance the teaching-learning in their respective classrooms (Kröger & Nupponen, 2019; Remer & Tzuriel, 2015). Participants reflected on the fact that a PoP (puppetry) could be an advantageous (or disadvantageous) pedagogical tool to implement in the intermediate phase mathematics classroom as part of their teaching-learning praxis (Gobec 2012; Korošec, 2012). Participants realised that they might have to move out of their teaching-learning praxis comfort zone but may adapt to accommodate the integration of puppetry into their respective mathematics classrooms in the future (see § 4.4)

It can be noted that intermediate phase mathematics teachers perceived PoP (puppetry) as useful, meaningful and helpful in their overall teaching-learning praxis, making mathematics understandable and accessible to all learners despite the school context or learners' personal contexts (Kröger & Nupponen, 2019). Although the implementation of puppetry might be perceived as difficult, it may be overcome by continuous teaching-learning exposure with a PoP (puppetry) (Gobec, 2012).

6.6.2 What are intermediate phase mathematics teachers' perceptions of metacognitive awareness before and during the intervention?

Participants' metacognitive awareness were based on their reflections (as prompted by the data collection instruments) on their metacognitive knowledge of person, task and strategy as well as self-regulation with regard to planning, monitoring and evaluating to emerge (Flavell, 1979). They were able to identify workable solutions relating to their teaching-learning praxis

in their respective mathematics classrooms by reflecting on how puppetry might be applied regardless of their school context (Crescenzi, 2016) (see § 4.6)

As participants were based in rural and township schools, they faced more or less the same difficulties (tensions) – for example, underresourced classrooms and various socio-economic issues – which, to a large extent, influence learner engagement and understanding in mathematics (Reddy et al., 2003). Participants did not know what metacognition entailed prior to the intervention. They realised during the intervention that metacognition forms an essential aspect of their daily teaching-learning praxis. They also mentioned that, as they learned what metacognition entailed (due to the intervention), they would be integrating it to a larger extent in their classrooms respectively. Their metacognitive awareness of what, how, why and when they teach certain topics in their respective mathematics classrooms may lead to them becoming more critical reflective practitioners (Ertmer & Newby, 1996; Shetty, 2014).

6.6.3 How do intermediate phase mathematics teachers prepare lesson plans and puppetry scripts to implement in their classrooms during the intervention?

Participants prepared lesson plans and puppetry scripts in a more detailed manner than they realised. They prepared lesson plans from a holistic approach, integrating real-life examples that were easily relatable for learners, hence making mathematics more accessible and understandable for learners via the puppet (as mediator) (Ahlcrona, 2012). The presentations during the intervention and the guidelines in the intervention booklet assisted them to write puppetry scripts, to mathematise those scripts and integrate them into their lesson plans. Participants' lesson planning was effective, and they easily established what they wanted to reach (outcomes or lesson goals). Puppetry script writing was new (deemed to be difficult) to them and they struggled with it at first as they were unsure as to how to write a plot (problem) in their script and relate it to their mathematics lesson (Remer & Tzuriel, 2015). Participants were also unsure as to whether their scripts should have been written based on a general storyline (indigenous stories) or based on a regular dialogue revolving around the plot (see § 4.8)

As script writing is a creative and innovative process, together with puppetry aligning with the art of drama, it may not have been in all participants' nature to find the art of script writing easy (Acharya, 2017; Dahlstrom, 2014). Their lesson planning assisted them with an established goal which might have directed the plot their puppet character faced; however, script writing (as well as the mathematising of the script) is a process that requires practise.

6.6.4 What are intermediate phase mathematics teachers' lived experiences with the transfer of pedagogies of play (puppetry) after the intervention?

Participants' experiences allowed for enrichment of their teaching-learning praxis. Their PCK and SMK were enriched by integrating a creative and innovative approach like PoP (puppetry), hence allowing them to reflect (and/or adapt) their MKT, which may be beneficial for both intermediate phase teacher and learner (see § 5.4)

Participants seemed to have enjoyed the implementation of a PoP (puppetry), although they faced challenges (Keogh et al., 2008; Korošec, 2012; Maharani, 2016; Remer & Tzuriel, 2015). They mentioned struggles and frustrations during the planning and presentation of their lesson with a PoP (puppetry), but these were outweighed by learner interaction, responses and overall performance during the lesson as a PoP (puppetry) allowed for a hands-on, minds-on lesson which was regarded as active and fun, enhancing teaching-learning in the intermediate phase mathematics classroom (Hughes, 2014; Keogh et al., 2008; Smith, 1979).

6.6.5 What are intermediate phase mathematics teachers' lived experiences of the transfer of metacognitive awareness after the intervention?

Participants were possibly more metacognitively aware of their teaching-learning praxis after the intervention as they critically reflected on their lesson with a PoP (puppetry). According to Yeschenko (2017), teachers (participants) reflect critically when they enhance their PCK (broadening their PCK by teaching-learning with PoP [puppetry]), hence aligning their PCK with teaching-learning goals (integrating PoP [puppetry] successfully to enhance intermediate phase learners' mathematics classroom experience). Therefore, mathematics became not only meaningful but also accessible to their learners (Ertmer & Newby, 1996) (see § 5.6)

Reflection was the "glue" that bound metacognitive knowledge and self-regulation together such that it allowed for participants to be more metacognitively aware of elements such as *how* they taught, *why* they taught like they did, *when* to teach certain topics – therefore, allowing for a shift in their teaching-learning praxis, since they were more careful about the way in which they approached their lesson with a PoP (puppetry) (Ertmer & Newby, 1996; Shetty, 2014). Participants made plans as to how they allowed for a problem to surface (the plot as experienced by the puppet); the strategies which the learners had to employ to assist the puppet; why the puppet faced that particular problem; and when to guide learners (as the teacher, not the puppeteer) so that they could reach lesson outcomes successfully.

6.7 Primary research question binding this study together

For the purpose of this study, one overarching research question was identified. The primary research question was interconnected to each of the secondary research questions.

6.7.1 What are intermediate phase mathematics teachers' lived experiences of an intervention based on pedagogy of play (puppetry) and metacognitive awareness to enhance SDL?

The primary research question was multifaceted. Figure 6.1 illustrates firstly, how the intervention took place across the ZPTD, allowing for teacher professional development to take place. Secondly, it illustrates how PoP, overarching to puppetry allowed for the five domains: (i) increased generation of communication; (ii) fostering a positive classroom environment; (iii) creating a creative space; (iv) fostering cooperation and group integration and (v) influencing learner attitudes) to emerge based on participants' experiences during after the intervention. Thirdly, metacognitive awareness pertaining to metacognitive knowledge and self-regulation is presented as to the way in which it surfaced in participants' classrooms and fourthly, how SDL emerged after the endeavour where participants took the knowledge gained from the intervention, to their respective classrooms and made it their "own". It was evident that reflection featured as a means to link each of these elements present in the synthetisation of this research in order for participants to learn from the intervention and apply it in practice and to improve upon what they have learned for future teaching-learning endeavours.



Figure 6.1: Synthesis of primary research question

(adapted from Ertmer & Newby, 1996; Fani & Ghaemi, 2011; Flavell, 1979; Knowles, 1975; Kröger & Nuponnen, 2019; Warford, 2011)

The intervention took place across the ZPTD (Figure 6.1), as suggested by Warford (2011). The aim of the intervention was to develop participants from their point of departure (dependent of teacher factors [Rogan & Grayson, 2003], such as years of teaching-learning experience, language of teaching-learning, and qualifications or professional development). The intervention seemed to have been supportive overall and the materials the participants received (such as the intervention booklet with guidelines on puppetry, puppetry script writing and one puppet per participant) assisted them to integrate these materials with their then knowledge of lesson planning, hence writing the scripts and teaching the lesson for their respective intermediate phase mathematics classes (Keogh et al., 2008; Korošec, 2012; Kröger & Nupponen, 2019; Maharani, 2016; Remer & Tzuriel, 2015). Participants found a PoP (puppetry) to be a successful pedagogical tool which enhanced their teaching and their learners' learning despite the challenges faced in rural and township schools (Kröger & Nupponen, 2019; Reddy et al., 2013). During and after the intervention, they became more metacognitively aware of their personal teaching-learning praxis. They reflected and acknowledged that a PoP (puppetry) could make a positive contribution to their classrooms as it made mathematics understandable, meaningful and accessible to their learners.

Based on this discussion on the multifaceted nature of the primary research question, it can be suggested that participants engaged in this study as positive self-directed learners themselves. Since metacognitive awareness is the engine that drives SDL (Shannon, 2008), participants were goal-orientated to teach with a PoP (puppetry) as they perceived it as having the ability to enhance teaching-learning in intermediate phase mathematics. They reflected on their own teaching-learning praxis, and their self-evaluation allowed for critical reflection, indicating where they might be able to improve, adjust or amend their praxis, hence changing their initial perceptions. Participants set goals for their lessons and were able to make informed decisions before, during and after their lesson, using a PoP (puppetry) as a scaffold to improve teaching-learning in their respective classrooms (Havenga, 2014; Knowles, 1975; Van der Walt, 2017).

Participants' lived experiences of the intervention allowed them to obtain critical skills (such as teaching-learning through a PoP [puppetry]; metacognition and script writing), allowing them to transfer this knowledge to their respective intermediate phase mathematics classrooms. The intervention and overall teaching-learning with a PoP (puppetry) were positively implemented in these participants' classrooms. They were also able to reflect more critically (in detail) as to how they experienced their lessons, which might be evidence of enhanced metacognitive awareness. In essence, this motivated undertaking in participants' teaching-learning could be regarded as enhancing SDL as participants had to adapt their teaching-learning praxis at the time, obtain new

knowledge about a PoP (puppetry) and apply it successfully where the learners met the lesson goals or outcomes (Knowles, 1975).

6.8 Recommendations for future research endeavours

Participants seemed to have gained knowledge of and skills in a PoP (puppetry), which they did not have prior to the intervention. It can be noted that professional development occurred, allowing them to establish distance (in a self-directed manner) between their actual development (what they were able to accomplish before the intervention) and their potential (proximal) development where they collaborated with peer colleagues and facilitators to become knowledgeable in their respective intermediate phase mathematics classrooms (Warford, 2011).

There are several other aspects that might serve as considerations for researchers in the field of PoP (puppetry) and mathematics education. I recommend that future studies be conducted over an extended period as teachers get so busy with their daily teaching and administration at the school that they would neglect the knowledge they have gained from the PoP intervention. Frequent follow-up visits can support teachers when they need advice on a lesson or puppetry script or just for encouragement. Researchers have to keep in mind that teachers (often the only teachers teaching at smaller schools – typically rural and township schools) who want to implement PoP might become isolated and no one may be available with whom they could discuss common issues of PoP. Furthermore, this intervention took place on two consecutive Saturdays; however, at least three workshops might be beneficial to participants and may strengthen the data collected in such a study.

6.8.1 For researchers

Research on the three-fold interrelatedness between PoP (puppetry), metacognition and intermediate phase mathematics (focusing on teachers as participants) to enhance their SDL may possibly contribute to design principles of puppetry workshops, puppetry script writing workshops, and adapted lesson study planning workshops where script writing may be integrated for future research endeavours. A case study on how teacher participants in different school contexts (rural, township and urban) contextualise their puppetry scripts to integrated into their lesson plans might also lead to improved understanding of how they (teachers) prepare their lessons similarly and differently for their learners (context). In addition to focusing on teachers, future research might also comprise a learner component, exploring how learners experience a PoP (puppetry) so as to possibly enhance their understanding.

6.8.2 For teachers

The data that emerged from this study inform the body of scholarship on the importance of a PoP as teaching-learning approach in mathematics and how teachers can be more metacognitively aware of how they teach. As learners perceive mathematics as “boring”, a creative and innovative approach like puppetry may lead to a shift in perception among learners with regard to the mathematics classroom. I recommend that teachers in the intermediate phase (in particular) obtain professional development within the field of STEAM education (which includes a PoP [puppetry]). As puppetry is a fun pedagogy (unlikely in the intermediate phase mathematics classroom), learners may benefit as it allows them to express their thinking without feeling discouraged or anxious. Non-participating peer colleagues at participating schools may also benefit and it is recommended that the participants in this study involve their colleagues in teaching-learning with a PoP (puppetry) as they now have experience in this field. It is also recommended that participants document their teaching-learning endeavours with PoP (puppetry), which may inform design principles for future professional development interventions.

6.9 Limitations for future research endeavours

Since the intervention in this study occurred over two consecutive Saturdays, time was deemed to be a limitation in this study as I was unable to perform class visits when participants engaged in teaching-learning with a PoP (puppetry) so that I could better understand and comprehend their experiences. Participants were also only able to attend two workshops (and not three as planned originally) due to their personal work schedules.

Participants’ reflections might be strengthened by follow-up interviews after classroom visits where additional short interviews may be conducted, assisting them in their reflective praxis. Classroom visits may also occur more than once to support participants in their endeavours in teaching-learning with a PoP (puppetry).

Another limitation of this study was that the focus was on intermediate phase only. Other phases’ teachers and/or learners might benefit from PoP as well, since puppetry influences learners of all ages because of its captivating nature (Brits et al., 2016; Keogh et al., 2007).

6.10 Concluding remarks

Since mathematics is the basis of everyday life, the fact that intermediate phase may be empowered through professional development on innovative approaches like a PoP (puppetry) may lead to social empowerment. If mathematics is made understandable, accessible and fun for learners based on the integration of real-life examples (via puppets), it becomes meaningful for learners. Active learner engagement may improve the overall teaching-learning quality in the intermediate phase. The results of this study indicate that a PoP (puppetry) is a successful pedagogy after implementation in the intermediate phase mathematics classroom. Since participants were able to reflect metacognitively (based on their perceptions, perspectives, understanding and feelings) on the teaching-learning experience of a PoP (puppetry), they experienced various advantages, allowing for learner improvement upon assessment. The participants in this study contributed to a first-of-its-kind study in intermediate phase mathematics in South Africa (based on available research in the Afrikaans and English languages). Therefore, the doorway is open for future research on PoP (puppetry) and metacognition, which may provide numerous possibilities that may inform teacher professional development endeavours.

“To those who stay put, the world is but an imaginary place. But to the movers, the makers and the shakers, the world is all around, an endless invitation” (Unknown)

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ANNEXURE A – CONFIRMATION LETTER OF LANGUAGE EDITOR

Dr. JACKIE DE VOS

Academic copy editor / Akademiese teksredakteur

BA (Psychology & Communication studies), BAHons (Psychology) (NWU)
MEd, PhD (Educational Psychology) (NWU)
BAHons (Translation) (UNISA)
MA (Linguistics) (UNISA)
BA (Sielkunde & Kommunikasiestudies), BAHons (Sielkunde) (NWU)
MEd, PhD (Opvoedkundige Sielkunde) (NWU)
BAHons (Vertaalkunde) (UNISA)
MA (Linguistiek) (UNISA)

072 435 8024

Jackie de Vos

acadwritingconsult@icloud.com

EDITING

22 November 2019

To whom it may concern

This letter serves to confirm that the following dissertation was edited:

**“Pedagogies of play to develop intermediate phase mathematics teachers’
metacognitive awareness”**

The onus is on the client(s) to work through the proposed track changes and to accept or reject proposed changes. Clients might make changes to the content after the editing process. Clients should also make certain that all sources/references have been cited.

ANNEXURE B – ETHICAL CLEARANCE OF STUDY



4 February 2019

To Whom It May Concern

I hereby confirm that the ethics application, as stated below, is approved by the members of the Ethics Committee of the Faculty of Education and will be minuted at the Ethics Committee meeting on 21 February 2019.

Ethics number: NWU-00788-18-A2

Project head: Prof MS van der Walt

Project team: Ms E Potgieter

Title: Pedagogies of play to develop intermediate phase mathematics teachers' metacognitive awareness

Period: 4 February 2019 – 4 February 2020

Risk level: Low

Should you have further enquiries in this regard, you are welcome to contact Prof Jako Olivier at 018 285 2078 or by email at Jako.Olivier@nwu.ac.za or Ms Erna Greyling at 018 299 4656 or by email at Erna.Greyling@nwu.ac.za.

Yours sincerely

Prof J Olivier
Chair Edu-REC

ANNEXURE C – PERMISSION TO CONDUCT RESEARCH



education

Lefapha la Thuto la Bokone Bophirima
Noord-Wes Onderwys Departement
North West Education Department
NORTH WEST PROVINCE

Teemane Building, 8 O.R. Tambo Street,
Potchefstroom
Private Bag X1256, Potchefstroom 2520
Tel: (018) 299-8216 / Fax: 294-8234
e-mail: bmonale@nwpg.gov.za
Office Manager: Linda Nelson - Tel: (018) 299-8264
e-mail: Lnelson@nwpg.gov.za

OFFICE OF THE DISTRICT DIRECTOR Dr KENNETH KAUNDA DISTRICT

Enquiry: Max Bolofina: 018 299 8307

Tel:(018) 299 8264 / e-mail : bmonale@nwpg.gov.za

To: North West University
School of Mathematics, Science and Technology Education

Attention: Prof. Jaco Olivier
o.b.o. Erika Potgieter

From: Mr. B. Monale
District Director

PERMISSION TO CONDUCT RESEARCH

Reference is made to correspondence from the University Ethics Committee dated 24th February 2019 as well as your subsequent contact with the Department of Education in Dr. Kenneth Kaunda District, regarding your request for permission to conduct research. Accordingly, approval is hereby granted to you to conduct research under the topic:

*“Pedagogies of Play to Develop Intermediate Phase Mathematics Teachers’
Metacognitive Awareness.”*

Please take note that the research process must conform to the following provisions:

- That the onus to contact your target schools and to identify suitable project participants for purposes of the research remains with you.
- That participation in the project will remain voluntary for its entire duration.
- That you take reasonable measures not to compromise Learning and Teaching time in respect of your research participants.
- That the general functionality of schools should not be compromised by this research project, considering that the same will in instances involve teachers.
- That the outcomes of your research will be shared with the NW Department of Education, or its proxy, upon request.
- That the principle of confidentiality will be observed in its strictest terms in relation to information sourced from the project.

With our Best Wishes

Duly Authorised

Mr. B. Monale
District Director:
Dr. Kenneth Kaunda District



Cc: Mr. M. Mogaki; Acting Sub-district Manager J.B. Marks
Ms. N. Seokolo: Acting Sub-district Manager Matlosana



“Towards Excellence in Education and Sport Development”

ANNEXURE D – INFORMED CONSENT (PRINCIPALS)



Private Bag X6001, Potchefstroom
South Africa 2520
Tel: 018 299-1111/2222
Faculty of Education
Tel: 018- 299 4776
Web: <http://education.nwu.ac.za/sdl>
Date: April 2019

Dear Principal and members of the School Governing Body (SGB) of XXX Primary School.

I am currently busy with my Masters Degree (Mathematics Education) at the North-West University Potchefstroom Campus. It is aimed that my research should be conducted in the North-West Province. My study is entitled:

'Pedagogies of play to develop intermediate phase mathematics teachers' metacognitive awareness'.

I would like to request permission from you as to whether I can conduct my research in your school (referring to the participants from your school) during the second term of 2019.

Here follows a brief summary of my intended research:

The aim of this study is to describe participating intermediate phase mathematics teachers' perceptions and experiences before, during and after an intervention (consisting of two workshops), addressing metacognitive awareness and pedagogies of play (puppetry).

There seems to be a gap in research conducted in the South African context regarding mathematics teachers' experiences of Pedagogical Content Knowledge (specifically pedagogies of play – referring to puppetry) and how it hinges on metacognitive awareness. No research has been found in English and/or Afrikaans literature on these topics in three-fold relation to one another.

I would like to invite two intermediate phase mathematics teachers at three schools respectively in the Dr Kenneth Kaunda District to participate in this intervention. Therefore, two (or more) intermediate phase mathematics teachers from your school will be invited to participate in this research should you agree for this research to be conducted. The intervention will take place on two Saturdays where lunch and refreshments will be provided at the University's Faculty of Education, Building B10.

- (i) Workshop one: The first workshop will serve as an introduction and orientation workshop where your participant teachers will learn more about different pedagogies of play (puppetry) and metacognition (metacognitive awareness).

- (ii) Workshop two: Your participant teachers will plan a lesson using puppetry based on the content which you will be teaching in the following two to three weeks in your irrespective intermediate phase mathematics classrooms.

The means of data collection which I propose to use are interviews; reflective prompts; observations and reflective journals before, during and after the intervention.

Should you give permission to conduct my research in your school, please note that all data collected will be handled in the strictest confidentiality. The participants, learners and school's identity will not be revealed. No personal information of any kind will be made public or published and no data will be used outside the parameters of this research.

Should you and your School Governing Body agree for two (or more) of your intermediate phase mathematics teachers to participate in my research, they will receive puppets and a mathematics kit on a complimentary basis for further use in their classrooms for future endeavours.

It would be appreciated if you could notify me soon as possible of your decision relating to my study. If you agree, you are kindly requested to sign the accompanying form. Should you have any further questions, please feel free to contact me or my supervisor.

With thanks.

Kind regards



Student: Erika Potgieter
018 299 1875
23423455@nwu.ac.za



Study supervisor: Prof M.S van der Walt
018 299 1854
marthie.vanderwalt@nwu.ac.za

By signing below, I principal of agree that my school and teachers as specified in this letter, may take part in the research study conducted by Ms Erika Potgieter (23423455) entitled:

'Pedagogies of play to develop intermediate phase mathematics teachers' metacognitive awareness'.

Signed at (place) _____ on (date) ____/____/20____

Signature of principal

Signature of witness

ANNEXURE E – INFORMED CONSENT (PARTICIPANTS)



Private Bag X6001, Potchefstroom
South Africa 2520
Tel: 018 299-1111/2222
Faculty of Education
Tel: 018- 299 4776
Web: <http://education.nwu.ac.za/sdl>
Date: April 2019

PARTICIPANT CONSENT FORM

Dear teacher

I herewith wish to request your consent for your participation in this research. Before you give consent, please acquaint yourself with the information below.

This study has been approved by the Ethics committee of the Faculty of Education of the North-West University and will be conducted according to the ethical guidelines of this committee. This is a low risk study. Permission was also granted from the Department of Basic Education (Dr Kenneth Kaunda District) as well as your school principal and School Governing Body (SGB).

The details of the research are as follows:

Title of the research study

'Pedagogies of play to develop intermediate phase mathematics teachers' metacognitive awareness'.

Information of this study for you as participant

I am currently conducting my M.Ed degree (Mathematics Education) at the North-West University and would like to request permission to conduct my research with you as teacher participant during the second school term of 2019. My study deals with how intermediate phase mathematics teachers can utilize puppetry as a pedagogy of play in their classrooms. Pedagogies of play might hold affordances that other pedagogies (such as transmission mode teaching) might not and may assist teachers in teaching-learning to improve access to concepts, procedures and relationships in abstract school mathematics, making it more meaningful and accessible to learners

I would like to invite you as well as one other intermediate phase mathematics colleague from your primary school to participate in a planned intervention. The intervention will consist of two workshops which will entail the following:

- (i) Workshop one: The first workshop will serve as an introduction and orientation workshop where you will learn more about different pedagogies of play (puppetry) and metacognition (metacognitive awareness).
- (ii) Workshop two: You will plan a lesson using puppetry based on the content which you will be teaching in the following two to three weeks in your irrespective intermediate phase mathematics classrooms.

We would like to host these workshop on two Saturdays (if possible, otherwise a venue convenient for you) where lunch and refreshments will be provided at the University's Faculty of Education, Building B10.

If you grant your consent, all collected data will be treated confidentially and will by no means be used outside of the parameters of this research. You are also welcome to withdraw from this research at any stage. No questions will be asked and no explanation regarding your withdrawal have to be disclosed. No personal information of any kind will be disclosed or published. It would be very appreciated if you could notify me as soon as possible of your decision. As participant, you must give written consent to the request as mentioned above. If you agree, you are kindly requested to sign the accompanying form.

If you have any questions, please contact me or my supervisor.

DECLARATION BY PARTICIPANT:

By signing below, I agree to take part in the research study entitled:

'Pedagogies of play to develop intermediate phase mathematics teachers' metacognitive awareness'.

Signed at (place) _____ on (date) ____/____/20____

Signature of participant

Signature of witness

With thanks.

Kind regards



Student: Erika Potgieter
018 299 1875
23423455@nwu.ac.za



Study supervisor: Prof M.S van der Walt
018 299 1854
marthie.vanderwalt@nwu.ac.za

Faculty of Education Research Ethics Committee: Ms Erna Greyling
018 299 4656
erna.greyling@nwu.ac.za

ANNEXURE F – REFLECTIVE PROMPTS IN INTERVENTION BOOKLET

REFLECTION 1: PEDAGOGY OF PLAY SESSION (13 Jul @ 09:15 – 10:30)

Please reflect on this section of the work by answering the following questions as complete as possible.

1. What was the most important idea/fact you learned during this presentation?
2. What important question remains unanswered? (Is there something regarding the pedagogy of play which you still do not understand?)
3. According to your understanding, list advantages/disadvantages regarding the use of the pedagogy of play in the intermediate phase mathematics classroom.
4. Would you use puppetry as the pedagogy of play to teach mathematics in your classroom? Why or why not? Please motivate your answer?
5. How do you think learners would perceive the use the pedagogy of play in a mathematics classroom?
6. Make a summary of what you have learned regarding the pedagogy of play in the teaching-learning of mathematics in your own words:

Write your ideas down here as we go along:

REFLECTION 2: METACOGNITION SESSION (13 Jul @ 10:45 – 12:15)

Please reflect on this section of the work by answering the following questions as complete as possible.

1. What was the most important ideas you learned during this presentation?
2. What important question remains unanswered? (Is there something regarding metacognition which you still do not understand?)
3. Make a summary of what you have learned regarding the presentation of what metacognition is in your own words:

Write your ideas down here as we go along:

REFLECTION 3: PUPPET SHOW, FEEDBACK AND REFINEMENT

(20 Jul @ 11:30 – 12:30)

Please reflect on this section of the work by answering the following questions as complete as possible.

1. What was the most important ideas you learned during this activity?
2. What important questions remains unanswered? (Is there something regarding puppetry which you still do not understand?)
3. List advantages/disadvantages regarding the use of puppetry in the intermediate phase mathematics classroom.
4. Would you use puppetry as a pedagogy to teach mathematics in your classroom? Why or why not? Please motivate your answer?
5. How do you think learners would perceive the use of puppets in a mathematics classroom?
6. Make a summary of what you have learned regarding puppetry in the teaching-learning of mathematics in your own words:
7. Did you enjoy to use puppets to enact a story and to derive mathematical principles embedded therein?
8. Based on the dialog which you chose to enact, which mathematical principles were embedded therein which could serve as a possible future lesson in your mathematics classroom?

ANNEXURE G – POWERPOINT PRESENTATION (POP)



What is pedagogy of play (PoP)?

- Learning through play!!!
- Learning through play can occur by implementing various games like card and board games, indigenous games (like Morabaraba); puppets or even computer-based gaming.
- Uses play as an experience for learners to learn topics and concepts in mathematics;
- PoP allows learners self-control, since they are more involved and intrigued in the learning process.
- PoP is very meaningful, since it creates new learning experiences in which learners can learn and embody new information!

What is pedagogy of play (PoP?)

- PoP assists learners to experiment with behaviours (like engaging with the rules of the game), which are also present in their real-life experiences – “rules of life”
- It is FUN and ENJOYED by learners, since they are not used to being taught in such a manner.
- Play is very “limited” to playgrounds / after school – the switch from foundation phase from concrete mathematics to abstract mathematics is quite a leap! Foundation phase is play orientated and Intermediate phase is suddenly abstract and “different” – it confuses learners!



What is pedagogy of play (PoP?)

- As soon as learners engage in play in the classroom, their expertise, imaginations, playfulness and improvisational competence creates a unique experience where teaching-learning is optimised.
- PoP is done easily by learners, without fearing any obstacles (accepting the challenge) while the knowledge is remembered over a period of time



Puppetry as PoP

- South Africa is a multicultural society. Learners across various cultural backgrounds and social settings come together to engage in teaching-learning tasks;
- Indigenous knowledge is a local knowledge (context specific - occurring in a specific place) and is different to other ways (western ways) of knowing. Indigenous knowledge can be transmitted orally (via storytelling), and is holistic of nature.



Puppetry as PoP

- Storytelling is the oral tradition of many indigenous knowledge holders in Africa including South Africa, where it was used to convey knowledge to children, to teach them valuable lessons of life and to prepare them for various encounters;
- Storytelling and puppets as PoP can be an appropriate medium to use in classrooms, because it involves effective communication;
- storytelling creates interest, enhances understanding and memory regarding the information pertained in the story and captures interest.

Puppetry as PoP

- Storytelling hinges on emotions, which entails improved comprehension and understanding by learners;
- Storytelling can be fostered by the incorporation of drama mediums like puppetry;
- When referring to school mathematics, creativity and imagination is dampened, resulting in uninterested learners;
- Creativity and imagination has educational potential in school mathematics and puppetry may create these teaching-learning environments

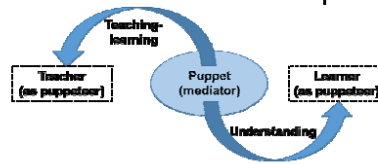
Puppetry as PoP

- The idea that a puppet “is alive” have always fascinated human kind and inspired their imagination;
- A puppet can be defined as a material artefact which incorporates specific movements – the activities in which puppets engage allows for its communicative potential to emerge, allowing for the spectator's (learners') thoughts, emotions and associations to be hinged on these activities.



Puppetry as PoP

- Puppetry can be applied as a mediating tool where the teacher as puppeteer expresses a motive which learners interact with;
- Another form of mediation emerges where the learner as puppeteer expresses understanding when they use the puppet to engage in conversation with the teacher or a peer.



Puppetry as PoP

- When a puppet used by teachers, relief is experienced by learners in the sense that the learners are relieved of their fear of authority, establishing contact with their classroom environment and what is being taught;
- Learners often confide in the puppet, they like to touch and stroke it leading to relaxed conversations of content which enables teachers to meet curricular goals in a positive classroom environment

Puppetry as PoP

- When a puppet is used by learners, they tend to express themselves, because should errors be made, it is made on account of the “puppet as an individual” and not by the learner;
- The teacher can also identify misconceptions in the learners' understanding when explaining a specific mathematical topic and pose these questions to the puppet, allowing the learner to take note of these errors and learn from them.



Puppetry as PoP

- Teachers who use puppets, move from a traditional teaching-learning praxis to a more reflective practitioner, due to the puppet who:
 - does not understand the teaching-learning material (linguistic intelligence);
 - raises issues and questions (spatial intelligence) and
 - present misconceptions, challenging the learners to engage in a problem-solving manner



Puppetry as PoP

- Puppetry creates a doorway for authentic problem-solving that is rooted in learners' real-life experiences, allowing them to identify with the problem faced by the puppet character;
- Puppetry has a powerful influence on learners from all ages, because its movements to convey teaching-learning material is captivating;
- Puppets allow teachers and learners to engage with one another, getting to know and learn from one another, grow and be self-confident- and expressive by relating openly to what the puppet character is facing because the puppet is viewed as a peer and therefore, depersonalised,

Puppetry as PoP

- Teachers who use puppets can transform barriers to learning (like oppositional behaviour, negativity and defensive attitudes towards a subject) to a positive teaching-learning environment;
- According research done at the Karyn Purvis Institute of Child Development (2016), it takes the brain approximately 400 repetitions to form a new synapse pertaining to new learning material, but when done through play while learners experience enjoyment and feel safe, it takes about 12 repetitions!



Video 1

<https://www.youtube.com/watch?v=CiHshi1ioaM>



Dr Edward de Bono's

Six Thinking Hats®



Red Hat
intuition, hunches, & feelings



White Hat
information available & needed, facts and data



Yellow Hat
benefits, value & positive aspects



Black Hat
caution, difficulties, risks & weaknesses



Green Hat
alternatives & creative ideas



Blue Hat
managing the thinking, focus, summary

Using Hats

- Use De Bono's Six Thinking Hats and analyse the use of puppetry as pedagogy of play in the Intermediate Phase Mathematics Classroom.
- You need to provide information based on the color of your hat to reason about the problem above.

Educational contexts for using puppets

- The typical educational context for using hand puppets is that an educator plays a puppet theater for children. Puppet theatre as an art form is widely researched;
- Creating a puppet show together, including making the puppets, writing the script, creating the scenery, and performing the play, can be part of artistic education



Educational contexts for using puppets

- Puppets are also used in education without an actual theatre stage or script. For example, a teacher can use a puppet to ask children questions and discuss the questions with them. A puppet can also be a helpful tool in verifying children's understanding when they answer questions and participate in a dialogue



Five potential uses for puppets

1. Generating communication;
2. Supporting a positive classroom climate;
3. Enhancing creativity;
4. Co-operation and integration in groups;
5. Changing attitudes in mathematics.



Generating communication

- Puppets help to:

1. Increase and improve classroom talk;
2. Increase communication by creating a favourable, relaxed atmosphere, and;
3. Establish teacher-student interaction and children's mutual interaction.



Supporting a positive classroom climate

- Classroom climate has three components:
 1. Academic;
 2. Management;
 3. Emotional.
- Since puppets engage and motivate learners on all three of these levels, a positive classroom environment is the result, which increases learning.



Enhancing creativity

- Puppet play helps students develop creative skills and cognitive skills by forcing them to use their imaginations;
- Puppets make up the roles, the rules, the situations, and the solutions (and learners will start doing this too) – it gets easier for learners to explore the content or participate in the classroom!



Co-operation and integration in groups

- Some learners are shy; show-offs; hyperactive and lonely and each of them need special support;
- Direct communication with these learners are often difficult, but they need extra help to integrate into groups especially - **Here, a puppet can be a helpful tool!**
- When children create puppets and play with them, they become more self-confident.



Changing attitudes

- Puppets and puppetry have potential in changing attitudes when a puppet helps a child take a new perspective on a situation;
- Imagine when learners “invent” and explore new approaches in your mathematics classroom – this experience is priceless!



Video 2

- Based on the knowledge which you have gained, look at the following video and make notes of how the teacher integrates the puppet – which strengths and weaknesses can you identify?
- The video is not very audible, but look at the learners' reactions, how the teacher handles the puppet etc.

<https://www.youtube.com/watch?v=sHpLBxtmdZw&t=62s>



REFLECTION TIME!!!

- Please reflect in your booklet in the section entitled:
- **REFLECTION 1: PEDAGOGY OF PLAY
SESSION (13 Jul @ 09:15 – 10:30)**
- Read through the questions carefully and answer – there is no right or wrong answer!



ANNEXURE H – POWERPOINT PRESENTATION (METACOGNITION)



Metacognition defined

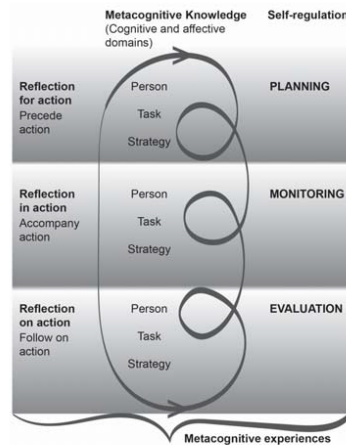
- Metacognition is a person's knowledge about the cognitive processes necessary for understanding and learning;
(Wilson & Bai, 2010)
- Metacognition is defined as individuals' ability to adapt cognitive activities and understand better, referred to as "thinking about thinking";
(Flavell, 1979; van der Walt & Maree, 2007)
- The word 'Meta'- refers to '*beyond*' and 'cognition' to '*knowing*'
(Shetty, 2014)

Metacognition

- Therefore, metacognition is the process of going beyond knowing for understanding to be reached.
- In education, metacognition refers to the process where teachers and learners reach an understanding of their thinking for them to put what has been learned into action.
- According to Flavell (1979), metacognition consists of two main components namely (a) Metacognitive knowledge and (b) self-regulation



Metacognition



Generating and integrating new and prior metacognitive knowledge through reflection

Metacognition

- Metacognitive knowledge – Factual knowledge of the task and strategy and how and what you as person know about this;
- Metacognitive experiences – Awareness and feelings during the problem-solving situation;
- Roleplayers in cognitive activities eg. Communication of info, reading, attention and memory.



Metacognitive strategies

- **Known as monitor, plan, control and evaluate;**
(Flavell, 1979)
- **Monitor** – refers to awareness regarding task performance;
- **Plan** – Setting of goals; asking for support; asking of questions and requesting info;
- **Control** – Skill enabling individuals to predict learning objectives;
- **Evaluate** - Skills to look at end product, overall performance, errors and solutions and to judge it accordingly.



Importance of metacognitive strategies

- The use of metacognitive strategies activates learners' thought processes, thereby facilitating deeper learning and improved achievement;
- These strategies promote reflection!!!



Importance of metacognitive strategies

- Metacognitive strategies enables learners to learn to analyse and discover the meaning of the problem;
- Unfold its hidden information and apply their understanding;
- They have to think about the problem;
- They have to interpret the problem and be able to describe it adequately in their own words;
- They then have to devise a plan and implement it;
- Lastly, they need to reflect upon their plan and adapt it if necessary.



Importance of metacognitive strategies

- Problem solving develops metacognitive strategies and leads to metacognitive aware individuals in society who is able to monitor, plan, control and evaluate their arithmetical reasoning;
- In contrast, these strategies do not facilitate routine procedures, memorisation and drill-practice.

(Department of Education, 2011)



Importance of metacognitive strategies

- How does metacognition and problem-solving fit together?
- It is important to first look at the definition of problem –solving:
- *In Mathematics, problem solving refers to the unseen, non-routine problems that require higher-order understanding and metacognitive skills to break the problem down into its constituent parts and to solve the problem meaningfully.*



Metacognition and problem-solving

- Metacognition is reflective of nature and makes individuals aware of common errors that they have made or are going to make.
- This awareness fosters responsibility for own learning, the diagnosing of learning needs, prevents deviation from learning goals and leads to the overall identification of appropriate resources in order to reach a specific outcome.



https://www.youtube.com/watch?v=mwl_gplTzhY



REFLECTION TIME!!!

- Please reflect in your booklet in the section entitled:
- **REFLECTION 2: METACOGNITION SESSION**
(13 Jul @ 10:45 – 12:15)
- Read through the questions carefully and answer – there is no right or wrong answer!



ANNEXURE I – SEMI-STRUCTURED OPEN-ENDED INTERVIEW SCHEDULE



Private Bag X6001, Potchefstroom
South Africa 2520
Tel: 018 299-1111/2222
Faculty of Education
Tel: 018- 299 4776
Web: <http://education.nwu.ac.za/sdl>
Date: 11 July 2019

PRE INTERVIEW QUESTIONS

There are **no right or wrong answers** here – it is **YOUR** point of view which **YOU** share with me anonymously.

Questions for semi-structured open-ended individual interviews before the intervention:

1. Tell me a bit about yourself – *i.e. Why are you start teaching? / What inspired you to start teaching?*
2. What is mathematics according to you?
3. How do you think learners learn mathematics according to you?
4. What is your mathematics teaching philosophy? *How do you teach? / Why do you teach in such a manner?*
5. What do you think are your teaching strengths and weaknesses according to you?
6. Have you ever heard the term “pedagogy of play”? Where? Please explain what it means to you?
7. Have you ever thought about using (teaching with) other pedagogies like games or puppetry in your intermediate phase mathematics classroom? Why or why not? Please explain.
8. What is your perception of teaching with a pedagogy of play - using puppetry?
9. Do you think that a pedagogy of play like puppetry can be a helpful teaching technique in intermediate phase mathematics? Why or why not? Please explain.
10. Briefly explain to me how you go about to plan a lesson.
11. Briefly explain how you monitor learners' progress during the lesson?
12. Briefly explain how and on what you reflect (thinking about your lesson) after you have taught a lesson.
13. Do you have any other questions or contributions which you would like to make in this interview?

ANNEXURE J – OBSERVATION SCHEDULE



Private Bag X6001, Potchefstroom
South Africa 2520

Tel: 018 299-1111/2222

Faculty of Education

Tel: 018- 299 4776

Web: <http://education.nwu.ac.za/sdl>

OBSERVATION SCHEDULE

Date: _____

Time: _____

Place: _____

Participants present:	
Criteria	Comments
As teacher participants engage in lesson planning, there are clear signs of CAPS aims broken down into clear and attainable lesson objectives	
Assessment strategies are aligned with teaching-learning	
The activities which have been planned pertains to the use of puppetry and aims to enhance the quality of teaching-learning and assessment.	
How do teacher participants perceive / experience the planning of lessons with a colleague?	
How do teacher participants perceive / experience the planning of lessons while using puppetry as PoP?	
How do teacher participants perceive / experience the writing of puppetry scripts for use in their lesson?	

Are teachers metacognitively aware when engaged in lesson planning? (i.e. taking metacognitive knowledge- and self-regulation variables into account?)	
What are common points of discussion among the teacher participants while engaged in lesson planning?	
Did lesson planning promote dialog among the teacher participants?	

General notes:

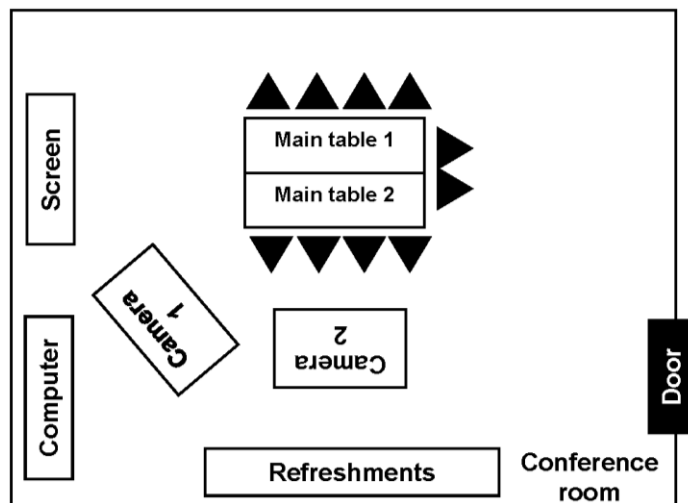
This image shows a single page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page, leaving small margins at the top and bottom. There are no vertical margin lines, text, or other markings on the page.

ANNEXURE K – SITUATION ANALYSIS



Private Bag X6001, Potchefstroom
South Africa 2520
Tel: 018 299-1111/2222
Faculty of Education
Tel: 018- 299 4776
Web: <http://education.nwu.ac.za/sdl>

SITUATION ANALYSIS



Key:

▲ Seats for participant teachers

ANNEXURE L – FOCUS GROUP INTERVIEW SCHEDULE



Private Bag X6001, Potchefstroom
South Africa 2520
Tel: 018 299-1111/2222
Faculty of Education
Tel: 018- 299 4776
Web: <http://education.nwu.ac.za/sdl>
July 2019

POST FOCUS GROUP INTERVIEW QUESTIONS

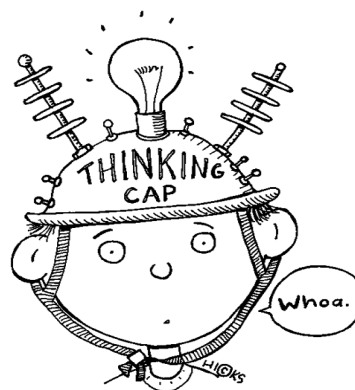
1. How did your perceptions about puppetry as pedagogy of play for teaching-learning in the intermediate phase change since the first workshop? Why or why not?
2. How did you find the guidelines / information you received during the intervention to write puppetry scripts with, to plan for teaching-learning with puppetry in the intermediate phase mathematics classroom?
3. How did you adapt / change your method of usual lesson planning in order to incorporate (accommodate) puppetry scripts in the teaching-learning with puppetry in the intermediate phase mathematics classroom?
4. According to your experience during the intervention, were you aware that you were planning, monitoring and evaluating your lessons metacognitively? Why or why not?
5. Why do you think that the use of puppetry as pedagogy of play is or is not a sustainable way of teaching-learning in the intermediate phase mathematics classroom?
6. How were you more aware of metacognitive strategies (i.e. the way in which you plan, monitor and evaluate your teaching-learning in your own classroom) during the past week (since our first workshop until the last one today)?
7. Would you say that these workshops assisted you to be more aware of the process of lesson planning, monitoring and evaluating (yourself and your learners), to become a more reflective practitioner? Why or why not?
8. Are you convinced of the effectiveness of puppetry as pedagogy of play for teaching-learning in the intermediate phase mathematics classroom? Why or why not?
9. Are there shortcomings or changes regarding this intervention which you would like to mention for future interventions on puppetry as pedagogy of play?

ANNEXURE M – REFLECTIVE JOURNAL TEMPLATE

REFLECTING ON YOUR PUPPETRY TEACHING-LEARNING EXPERIENCE

We do not learn from experience... we learn from reflecting on experience.

- John Dewey



WHY SHOULD YOU REFLECT?

- ✓ To think about how I learn, what I learn and what I do not learn.
- ✓ Because reflection makes things matter more.
- ✓ It shows me my power, and empowers me to take risks.
- ✓ It sharpens my vision, helps me to stay aligned with my goals, and warns me when I go off track.
- ✓ It helps me to identify what I want and what I need and how to get exactly that.
- ✓ What is rather cool, is that it also helps me realise how my gifts and strengths can help others.

WHAT IS REFLECTIVE JOURNALLING?

According to Bashan and Holsblat (2017), reflective journaling is key to establish stages of development undergone by participants. Reflective journals are an important part in the documentation of the process undergone by participants regarding growth in their teaching-learning praxis (Bashan & Holsblat, 2017). Reflective journals provide you as participant with the opportunity to give voice to your experiences with puppetry as pedagogy of play. Reflection is also a key ingredient in metacognition, so it provides me as researcher, insight on your thought processes (including pros and cons for future research endeavours concerning puppetry).

Please take note of the following:

- Use the template provided, accompanying these reflective journal guidelines to compile yours
- Start the write-up of your experience with puppetry as pedagogy of play as soon as possible after your lesson has been given
- Please ensure that your name, surname, school and date of lesson presented is included in your reflective journal.
- Please include the lesson plan of your lesson on puppetry as pedagogy of play, accompanying your reflective journal.
- You have 2 – 3 weeks after the second workshop (20 July), to submit your reflective journal back to me (9 August 2019).
- Make sure that you answer ALL of the key points in your reflective journal which will be discussed next:

**KEY POINTS IMPORTANT TO ADDRESS IN YOUR
REFLECTIVE JOURNAL**

Before you hand in your reflective journal, please answer the following questions as completely as you can:

1. A reflective "teaching philosophy": Describe your personal maths teaching philosophy. Why do you teach mathematics? How do you teach mathematics? / What is your personal mathematics teaching style (teaching strategies and objectives)? What is the context for your mathematics teaching? How should learners learn mathematics? How do you give feedback to learners about their work?
2. What do you believe is good teaching of mathematics? How do you feel about your own teaching? What are your teaching strengths and weaknesses?
3. What I expected this morning when my class began
4. What I experienced today
5. What is the most important thing I learned during my lesson with puppetry as pedagogy of play? Why do I think so?
6. What do I want to learn more about to improve future endeavours with puppetry, and why?
7. What I enjoyed most about my lesson with puppetry today. Why?
8. What surprised me during my lesson with puppetry today, and why?
9. What I liked least about my lesson with puppetry today. Why?
10. What I struggled with today or what I had trouble dealing with during my lesson with puppetry and why?
11. What frustrated me during my lesson with puppetry today? Why?
12. How my lesson today will impact my future endeavours to teach with puppetry in my mathematics classroom in the future.
13. Any additional comments?

Please give me a call / Whatsapp or SMS on _____ when you will find it appropriate for me to come and collect your reflective journal. It would be wonderful if you can hand in a hard copy, otherwise email me your reflective journal to _____

Please take note that upon collection, I would like to conduct one last interview with you which might take approximately 30 minutes of your time. Make sure that the date and time you specify is fitting for you and your school. If you decide to email me your reflective journal, please specify an appropriate date and time for the follow-up interview in the email.

Thank you for all your time and effort concerning this journaling process!



@ginihaforsythe May 4, 2011

REFLECTIVE JOURNAL OF:

NAME:

SURNAME:

SCHOOL:

DATE:

Start to type here: