UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Pre-service teachers responses to and reflections on contingent moments in intermediate phase mathematics teaching

A research report submitted to the Wits School of Education, in partial fulfilment of the requirements for the Master of Education degree in Mathematics Education.

By

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Declaration

I declare that this Research Report is my own, unaided work, except as indicated in the text and the references. It is being submitted for the degree of Master of Education at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

Signature: 

Date: 28 August 2025

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Abstract

This study investigated Pre-service teachers' responses to and reflections on Contingent moments in mathematics teaching at the Intermediate Phase level. The study examined how teachers adapt their instructional plans in response to spontaneous learner inquiries, misconceptions, or unexpected actions. Three pre-service mathematics teachers purposively selected participated in this study during their teaching experience. A total of nine mathematics lessons (three from each of the three teachers) were observed and video recorded. To gain an insight onto the teachers' thoughts and decision-making processes as they responded to contingent moments in their classrooms, video-stimulated recall (VSR) interviews were conducted with each teacher. The quality of teachers' responses to moments of contingency were analysed using Waston's (2015) coding protocol, categorising them as minimum, middle, or maximum level of appropriateness. VSR data were analysed using the Geiger et al. (2015) reflection-based framework, focusing on object of reflection as it pertains to: self, students or practice and levels of reflections as: technical, deliberate and critical. The study found that pre-service teachers varied in their responses to contingency moments, with stronger mathematical content knowledge linked to more effective responses. Teachers who asked low-cognitive-demand questions had fewer contingency moments, which limited student engagement. The study highlights the need for flexible Annual Teaching Plans (ATP) guidelines to allow deeper learner engagement. Additionally, pre-service teacher training should incorporate strategies for handling contingencies. Future research should explore the long-term impact of VSR reflections on teaching practice and the relationship between content knowledge and adaptive teaching. Professional development should focus on equipping teachers with skills to manage unplanned classroom interactions effectively.

Keywords: Contingency moments, content knowledge, pre-service mathematics teachers, intermediate phase, VSR interviews.

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ATP	Annual Teaching Plan
LoTL	language of teaching and learning
PCK	pedagogical content knowledge
PSTs	presents the analysis and findings of three pre-service teachers
SMK	subject matter knowledge
VSR	Video-Stimulated Recall

CHAPTER 1: INTRODUCTION AND MOTIVATION OF THE STUDY

1.1 Background to the study

Primary mathematics teachers' knowledge remains an issue of broad concern, not only in South Africa but also internationally (Bowie et al., 2019). It is well-known that in South Africa, most learners achieve extremely poorly in Mathematics at both primary and secondary school levels. Kriek & Grayson (2009) assert that "the poor state of mathematics and science education in South Africa can be attributed, in part, to much of teachers' limited content knowledge, ineffective teaching approaches and unprofessional attitudes towards change." The curriculum keeps on being modified every now and then, but teachers continue to use traditional methods of instruction even though so much in the world of education is changing. In addition, most teachers are often reluctant to pursue more education to stay current with the mathematics approaches being utilized today and the kind of subject matter that is required. Adler and Davis (2006) argue that teacher educators face challenges in embracing the content and pedagogical knowledge and teaching approaches necessary for teaching mathematics under the legacy of apartheid. They argue that most students who enrol into initial teacher education programmes have limited mathematics content knowledge, resulting from being exposed to poor teaching by inadequately qualified teachers. Department of Basic Education (DBE, 2004) concurs that if these students become teachers, when they have not received adequate training that equips them with both subject matter knowledge (SMK), pedagogical content knowledge (PCK), and teaching approaches, they may continue to perpetuate poor teaching practices, leading to a revolving cycle of poor achievement. It is because of this; the present study focuses on pre-service teachers' responses to and reflections on contingent moments during their teaching experience.

Turnuklu and Yeşildere İmre (2007) contends that "a common belief in society is if a mathematics teacher knows mathematics very well, he or she is the best person to teach mathematics" (p.2). It is indeed a necessary condition because one cannot teach what he/she do not know well. While knowing the subject well is a necessary condition, it is however not sufficient to assume that one can teach well. Because of this, a lot of individuals consider "more means better" and "results mean everything" to be signs of effective teaching. According to Newton (2007), the pursuit of high scores and quantity puts learners at risk of not understanding the content. Then, because teachers were more concerned with getting high scores than with quality, we wind up with students in Grade 4 who have little to no grasp of mathematics.

Shulman (1986) argues that teachers need more than just knowledge of their content area and generalised knowledge and pedagogy to be good teachers. He believed that they also need "the ways of representing and formulating the subject that make it comprehensible to others" (Shulman, 1986, p.9). Therefore, a teacher's mathematical content knowledge plays a crucial role in delivering a lesson and to further respond to questions that arise in the classroom, which were not planned for by the teacher. By teacher's mathematical content in this study, I refer to knowing mathematics well (SMK) and knowing well how to teach mathematics to others.

Rowland et al. (2015) state that a large portion of daily life involves some form of improvisation, a never-ending practice in dealing with the unpredictable. We have expectations for the hours ahead when we wake up every morning, but every day is full of surprises. Teaching new concept in Mathematics to learners is no different. Teachers plan specific deeds which they intend to do when they get to class and since mathematics curriculum now encourages learners to ask questions, teachers end up answering questions which they never planned. Responses to unplanned or unexpected events while teaching are often referred to as contingent moments, which is the focus of this study.

Contingency is one of the four dimensions of the Rowland's Knowledge Quartet. It is about a teacher being able to deviate from a plan in responding to learners' ideas and making use of opportunities presented by unexpected contributions (Rowland & Turner, 2007). Contingency is "witnessed in teachers' responses to classroom events that were not anticipated or planned, usually triggered by an answer or a remark contributed by a student" (Rowland & Zazkis, 2013 p. 138). Rowland, Thwaites, and Jared (2015) reported that three factors that can trigger contingency moments; arising from students, teacher insights or response to (un)availability of pedagogical tools.

The first one is when the contingency comes from students, it has to do with how the teacher responds to the ideas put forth by the students. According to (Rowland & Zazkis, 2013a), "student ideas can appear in three ways: (a) when answering a question, the teacher asked; (b) when responding spontaneously in a discussion; (c) when answering incorrectly." Teachers generally respond to students' ideas in one of three ways: either they ignore them, they acknowledge them but do not include them in the discussion, or they acknowledge and include their ideas in the class discussion.

The second one is about contingency that is triggered by the teacher himself/herself; we have a relationship with the teachers' insight code. The contingency, in this sense, stems from the teacher's reflection while developing/executing the task in class. It could be something new that improves the task's development/execution (a new idea or resource that he or she chooses to use). Additionally, when a teacher detects that a particular exercise, discussion, or explanation will lead to misunderstandings among the students, they decide to change the original plan. (Rowland, Thwaites, & Jared, 2015).

The last trigger of the contingency is the teacher's usage of resources, which is typified by the resources' (un)availability code. When a teacher prepares to use a resource, but it becomes unavailable for any reason, or when the teacher decides to use an available resource during class without having planned its usage beforehand, this therefore shows contingency. (Rowland, Thwaites, & Jared, 2015).

Abdulhamid & Venkat (2018) testifies that responding constructively 'in-the moment' to student offers is described as a critical, and yet difficult, aspect of skilful and responsive teaching. Therefore, research about contingency moments is important if teachers are to respond constructively in the moment to students' contributions. According to a study by Moodliar and Abdulhamid (2021), when presented with an unexpected question, a novice teacher did not press or probe students to understand their mathematical thinking in the moment, whereas an expert teacher often persistently pressed students in contingent incidents with follow-up questions to understand their thinking. This finding suggests that years of experience of teaching mathematics counts in equipping the teacher to provide appropriate response to contingent moments. However, preservice teachers don't have this kind of experience because they haven't been on the field of teaching. So, what Moodliar, and Abdulhamid's (2021) did not zoom into more in their study is the how preservice teachers responds to and reflect on contingent moments in the teaching of mathematics at the intermediate phase.

The focus on mathematics emanates from the persistent learners' poor performance in the subject and because of the limited research in this content area in the South African context. Studies have shown that mathematics is not only difficult for learners who must learn the subject, but similarly for the teachers who must teach it, especially preservice teachers. According to one teacher, the challenge is the incapacity caused by a lack of comprehension in the majority of mathematics learning content. The teacher mentioned that they were not

confident in this subject and needed assistance. Teaching skills such as the introduction of the lesson also seemed to be a challenge (Mabena et al, 2021). As a result, it is challenging to take steps to better prepare teachers to teach these subjects given the paucity of research in these content areas. This raises a concern to say, if the subject itself is deemed as difficult to teach and learn how much more is responding to contingent moments which teachers never planned for. On the other hand, a growing number of researchers have agreed that "there is ample evidence of the benefits and importance of contingent moments, for both students and teachers, if teachers know how to respond to them" (Forzani, 2014; Stockero & Van Zoest, 2013). It is unclear, nevertheless, if educators are prepared to handle these contingency moments in a way that will maximize the advantages of doing so. This is why this study aims to zoom into pre-service teachers' responses to and reflections on Contingent moments in mathematics teaching at the intermediate phase level during their teaching experience.

1.2 Statement of the problem

In today's classroom, a crucial component of students' academic performance is teachers' content and teaching it well, in a way that maximises students' questions, misconceptions and confusion about the content of mathematics. By content in this study, I mean both subject matter knowledge and being able to teach this content well. Pre-service teachers often struggle to respond effectively to contingent moments in mathematics classroom because some teachers are vastly knowledgeable to what they teach to students, how they teach students for understanding and to what the students can do with the knowledge, daily. Other teachers are less so. The difference according to Lappan (1999) is that the teacher's effectiveness, in large part, is enhanced or limited by the depth and breadth of our understanding and ways of representing mathematics itself. Understanding means having to respond effectively to contingency moments in the classroom and being able to probe to enhance understanding in the students. Mathematics already carries a negative stigma, so a teacher's lack of responses to contingency moments could mislead students into believing that it is a difficult subject. Additionally, how a teacher chooses to respond to questions and ideas raised by students in the classroom can influence how those students view the subject. If teachers dismiss most of the students' questions and ideas, that could also negatively send a bad message to students; on the other hand, if they are acknowledged, it could inspire students to enjoy the subject and do well in it.

Although researchers have extensively investigated the concept of contingent moments, we know little about how preservice teachers respond to and reflect on contingent moments in

mathematics teaching at the intermediate phase level. This study therefore aims to zoom into the how pre-service teachers' respond to and reflect on Contingent moments in mathematics teaching at the intermediate phase level. The study is important because generic teachers teach mathematics at primary school level. This is the practice in South Africa as well as many countries around the world where one teacher teaches almost all the subjects in a class. If teachers at this phase can respond more appropriately to contingent moments at primary school level, and others aren't able to, then as a country, we need to rethink about who to teach mathematics in our primary schools.

1.3 Purpose and objectives of the study

The purpose of this study is to investigate how pre-service primary school teachers' respond to and reflect on contingency moments in the teaching of mathematics at the intermediate phase level. Specifically, the study aims to achieve the following objectives.

1. To evaluate the quality of responses by pre-service primary school teachers to contingency moments encountered during mathematics teaching.
2. To analyse the types of reflections pre-service primary school teachers, provide on contingent moment incidents in the context of VSR interviews.

The VSR interview is a collaborative conversation between the researcher and the teacher after watching episodes of teaching. It is used as a tool for reflection of own teaching, and a means for supporting teaching development (Abdulhamid, 2022).

1.4 Research questions

The main research question is thus:

How do pre-service primary school teachers respond to and reflect on contingency moments in mathematics teaching at intermediate Phase level?

1.4.1 Sub-questions:

1. What is the quality of responses by pre-service primary school teachers to contingency moments encountered during mathematics teaching?

2. What kinds of reflections relating to contingent moment incidents do pre-service primary school teachers provide in the context of VSR interviews?

1.5 Significance of the Study

Researchers have attempted, via several ways, to justify and elucidate the concept of what defines a quality mathematics teaching. The related concepts of "powerful teaching" and "powerful learning," as studied by Darling Hammond (2016, p. 85), are among other things. According to Darling-Hammond (2016, p. 85) the significance of having the ability to "create knowledge for teaching that can enable more complicated, strategic learning is a sort of teaching that goes much beyond administering a test and assigning a mark to students." The current education system prioritizes administering examinations above imparting essential knowledge, hindering children's mental development and their ability to initiate rather than merely follow. Knowledge must be comprehended by the learner, ensuring its retention for practical application rather than only for passing an examination without any recollection of the instruction received. Because of this, the debate on the South African education system has resulted to no improvements, leading students to opt for Mathematical Literacy when they get to high school instead of Mathematics. Therefore, it is essential that this study looks at how pre-service teachers respond to and consider contingency moments when teaching mathematics in the classroom because it is essential to investigate and analyse preservice teachers' competencies in responding to and reflecting to contingencies inside the classroom. Teachers use this concept to encourage students to think critically, process and reflect on the material, identify connections between its main ideas, and apply the knowledge to solve problems, make decisions, and engage in other higher-order applications. which eventually means learning has taken place.

1.6 Summary

Chapter 1 introduces the study's focus on pre-service primary school teachers' responses to and reflections on contingent moments during mathematics instruction at the intermediate phase level. It highlights the persistent issue of poor mathematics performance in South Africa, often linked to teachers limited subject matter knowledge (SMK) and pedagogical content knowledge (PCK). The study underscores the critical role of teachers' ability to adapt to unplanned classroom events—referred to as contingent moments—when learners pose unexpected questions or challenges during lessons. Drawing on Rowland's Knowledge Quartet framework, particularly the dimension of contingency, the study investigates the quality of teachers' responses to such moments and their subsequent reflections in the context of VSR interviews. Prior research indicates that experienced teachers handle these situations more effectively, while pre-service teachers may struggle due to limited classroom exposure. This

research addresses the gap by exploring how pre-service teachers engage with these moments, with the goal of enhancing teaching quality and, ultimately, improving mathematics outcomes in primary schools in South Africa. The chapter also outlines the study's objectives and research questions, emphasizing its significance in informing teacher preparation programs and contributing to quality of primary mathematics teaching.

CHAPTER 2: SITUATING THE STUDY IN THE LITERATURE

2.1 Introduction

This chapter provides an overview of the study's literature review. The emphasis is on how preservice teachers respond to and reflect on the moments of contingency when teaching mathematics at the intermediate phase level. The chapter is organised into three parts. Firstly, the concept of contingency in the teaching of mathematics is discussed. Secondly, the role and importance of reflection of own teaching is presented. Finally, the theoretical perspective of the study is discussed.

2.2 Contingency in mathematics teaching

If I have not expected that something like this could happen, and if my repertory of actions is not rich enough to supply me with alternatives, then the lesson as intended may not be implementable (Mason, 2015). The new curriculum in South African schools calls for learners to participate in mathematics lessons and to express their mathematical ideas. The National Council of Teachers of Mathematics (2000) emphasizes that students should engage in meaningful dialogues in mathematics classrooms. There will undoubtedly be a wide range of student ideas, recommendations, or questions during these discussions; some of these will probably come as unexpected to the teachers and call for impromptu responses. For unexpected events to happen in the classroom there must be an environment in which creativity, on the part of the students, is a possibility (Coles & Scott, 2015). Not much has been researched about these practices and the impacts it portrays on teaching and learning mathematics in South African context.

Alan Bishop initiated a contingency study in the 1970s. He was interested in how teachers use tactics to buy time when faced with unexpected events that caught them off guard. (1997). Contingency on the other hand, “expresses the quality of the relationship between learning and instruction” (Wibowo & Dyson, 2021). In other words, contingency expresses degree to which a teaching method meets the needs of students and facilitates/supports their learning process. Mathematics teaching rarely proceeds according to plan. Contingency can also be in a behavioural form, where students do not seem to know what to do that is, behavioural unexpectedness. Students appear not to know what to do despite carefully crafted instructions.

The Knowledge Quartet, an empirical framework created by Rowland, Huckstep, and Thwaites (2005), has been used to evaluate and develop the mathematical knowledge of pre-service and

in-service math teachers as they are preparing and teaching. The four primary components of this framework are foundations, transformation, connection, and contingency. The last component of the knowledge quartet, contingency, is described as 'the "opposite" [their emphasis] of planning – to situations that are not planned and that have the potential to take a teacher outside of their planned route through the lesson' (Rowland and Zazkis, 2013, p. 139). "Contingency is concerned with a teacher's ability to make convincing, meaningful responses to unanticipated student answers, questions and statements." (Aytekin & Bostan, 2019).

At the international level, (Rowland & Zazkis (2013) observed that "the great majority of contingent moments are triggered by unexpected contributions by students and that the teacher's response to unexpected ideas and suggestions from students is one of three kinds: to ignore, to acknowledge but put aside, and to acknowledge and incorporate." Either way, the choice that teachers make is partly informed by the kind of mathematics content knowledge they possess. Mason (2015) reported that, an expert Japanese mathematics teacher once declared that "nothing should be unexpected for an expert teacher". This means, teachers with adequate and the right kind of content knowledge for mathematics teaching will never choose to ignore or acknowledge but put aside an unexpected moment in the classroom because they posses' knowledge which allows them to deal with every contingent moment triggered in the classroom.

Recent research has emphasized the need for teachers to be flexible, responsive, and reflective, particularly in the face of contingent moments, unplanned situations that arise during teaching and require on-the-spot decision-making (Rowland & Zazkis, 2013). This view is supported by Aytekin and Bostan (2019), who highlight that effective teachers must be able to make meaningful instructional decisions in response to unexpected student contributions, rather than strictly adhering to pre-planned lessons.

Building on this, Abdulhamid and Venkat (2018) introduced an 'elaboration' framework that categorizes teacher responses to students' mathematical ideas into various types of pedagogical moves. This framework has become increasingly influential in understanding teacher responsiveness in the South African context, especially in relation to primary mathematics instruction.

More recently, Moodliar and Abdulhamid (2021) explored how experience influences a teacher's ability to respond constructively in real-time to learners' unexpected input. Their study revealed that novice teachers tend to overlook or inadequately respond to contingent

moments, while more experienced teachers are able to press students with follow-up questions to explore their mathematical thinking.

According to Rowland, contingency is the teacher's ability to divert from a lesson plan as necessary, address students' questions, and correct their misconceptions. Because the act of attending to contingency moments would not be effective without sufficient topic knowledge for the subject, this ability requires a teacher to have sufficient subject knowledge. So, a teacher might be better able to react to contingency moment if they have a stronger understanding of maths.

2.3 The importance of teacher reflections after lessons

"I must know my song well/before I start singing." So, for musicians, as it is for teachers. Just stepping up and "winging it" when you are teaching mathematical concept is not good enough (Oldridge, 2017 p.6)**.** Most educators according to (lsanchez, 2023) would agree that "good teachers have the drive to constantly improve both instruction and student learning. Being an effective teacher is not an end in and of itself." Good teachers are growth-oriented, always working toward becoming better teachers. Mathematics teaching is being redefined every now and then in South Africa. Today, mathematics teaching is taken to mean thought provoking questions, eliciting activities and practical Feza (2014). By reflecting on your lessons, a teacher can now identify what went wrong, what they were unable to address or further explain, and how to better prepare for the next lesson so that they are ready to address any issues that arose during the first one. Shulman (1985) believes that "to be a teacher requires extensive and highly organized bodies of knowledge" (p. 47). However, despite all these insights, teacher education in South Africa still needs to work towards ending the cycle of poor teaching and poor learner achievement. It is my understanding that preparing pre-service mathematics teachers to deal with contingent moments while teaching is a necessary step in addressing the poor learner performance in South Africa.

In the area of teacher reflection, Abdulhamid (2022) examined the link between teachers' state of awareness and their reflective practices. Using video-stimulated recall (VSR), this research demonstrated how teachers can improve their responsiveness through structured reflection on classroom interactions. Reflection was found to evolve across levels technical, deliberate, and critical, each offering deeper insights into teaching decisions and learner engagement.

The use of VSR as a tool for developing reflective practice has gained traction internationally. Coles and Scott (2015) argue that for teachers to respond meaningfully to unanticipated

moments, they must cultivate a habit of reflection that reshapes not just how they interpret student contributions but also how they adjust their instructional moves in real time.

Recent studies reinforce the importance of preparing pre-service teachers to manage instructional uncertainty and engage in sustained reflective practice. As Mason (2015) puts it, a rich "repertoire of actions" is essential for dealing with classroom surprises—a repertoire built through experience, deliberate reflection, and exposure to varied learning situations.

Cimer et al (2013), contends that "recently, the concept of reflection has been widely used in a variety of different teacher education programs in order to help pre- and in-service teachers in the process of clarifying their ideas about their own teaching practices, and in considering and evaluating those ideas in the hope that they will develop the capacity to evaluate and improve their teaching practices". An effective method that can be used for teachers to be intentional in your own teaching, figure out what works, and create fresh views, ways of looking at their own actions, and new understanding of the students' behaviours is to be able to reflect on their own teaching. Through these teachers get an understanding that their lessons may not always proceed as planned; on occasion, they may need to deviate from their plan to correct a misconception, ask a question, or provide additional examples to clarify a subject while keeping an eye on how their students are behaving. This was the rationale for the need for the study to examine how preservice teachers respond to contingent moments as well as give them the opportunity to reflect on such instances for them to grow, learn, and make corrections later. Pre-service teachers are the target in this study because they are the future educators and are most suited to implement any changes that need to be made to our educational system.

2.4 Teaching and learning Mathematics in the intermediate phase.

At present, primary school learners in South Africa are not performing according to required mathematics standards. News that broke in 2023 revealed that 31% of Grade 3 students are below the grade level intellectually. According to Roberts (2017), there is a great deal of concern in South Africa regarding students' low mathematical performance in the classroom. There are several reasons for this, and according to Mabena et al., (2021), teachers' lack of pedagogical knowledge, attitude, and beliefs regarding mathematics, historical segregated educational practices prior to 1994, large class sizes, poor learning environments, and a lack of involvement from all stakeholders have all contributed to primary school students' poor mathematical performance.

Therefore, the student's chances of making up ground in the senior to EFT levels are quite slim because this begins at the foundation level and impacts the intermediate phase level. For change to occur in South Africa, research must concentrate on the foundation and intermediate phase levels.

According to (Makonye, 2013), "Teaching Mathematics has a unique structure that takes readers through the stages of how learners learn Maths, and how to teach Maths, before drilling down to the specific themes by phase." However, effective teaching and learning of mathematics are hampered by a wide range of issues. the difficulty faced by teachers in devising effective teaching methods and granting students autonomy in the classroom, leading to learners' inability to acquire math skills. According to the document*, teaching mathematics for understanding*, the results of South Africa's educational policies and curricula are not being achieved in the teaching and learning of mathematics in South African schools (2018). Even though mathematics is the foundation of science and technology, learners often shy away from learning mathematics. The student's performance in the subject has continually been dismal in both internal and external exams, which is particularly disappointing given the relative importance of mathematics (Adolphus, 2011).

Early change is what informs this study's focus on pre-service teachers at the intermediate phase level. It is important for pre-service teachers to be conscious of how they respond to contingent moments and to acquire more suitable techniques of provoking contingent moments in the classroom, open the lesson to let students learn by asking questions and participating in the lesson, and all of this should begin early in the students' academic journey. According to the constructivist theory of learning, students create their own knowledge. They learn therefore, through observation, listening, experimentation, exploration, and questioning, and through asking question**.**

2.5 Theoretical Framework

The categorization of situational nature of teachers' responses to contingent moments (Abdulhamid & Venkat, 2018) was used as lens in this study to understand how preservice teachers response to and reflect on contingent moments in the teaching of mathematics at the intermediate phase. Abdulhamid and Venkat (2018) describes three situations of learner offers at primary school level that may prompted a need for a teacher to respond in the moment while teaching. These are: breakdown, sophistication, and Individuation/ Collectivisation.

Breakdown is a situation where learners in a mathematics classroom offer incorrect answers. When incorrect responses are given, it is believed that providing learning support based on the needs of the learners is required for a teaching that is responsive and focuses on developing learner understanding.

Elementary mathematics curriculum stresses the necessity for growing sophistication by moving from inefficient to effective procedures and representations. So, sophistication refers to all the instances in which a learner (or learners) made a correct offer, but the teacher deemed it ineffective in terms of the strategy used or the representation. For example, using tally counts to work out the sum; 10+10+10. Since learners are being exposed to counting in 10s, it is therefore necessary for the teacher to make connections between the counting of 10s and adding 10s to discourage tally counts in this situation. Therefore, moving to effective strategies for effective learning is necessary to aid mathematics understanding. Again, a learner might want to add perimeter of a rectangle using tally mark, but what will happen when counting a perimeter of a big box with huge length? The strategy then is deemed ineffective since it can't work out an answer using big numbers, or since it might take forever to work out the answer.

Collectivisation involves a pedagogic move in a situation of correct and efficient offer been offered by individual learner, and the teacher projects to the collective classroom space. On the other hand, individuation is a situation of pedagogical moves from chorus correct and efficient offer to assessing individual learners. Attention to these pedagogic moves is necessary because of frequent lack of attention of learners' innovative offers in primary mathematics classrooms in South Africa (Abdulhamid & Venkat, 2014, 2018). There is also evidence of prevalent of chorus offers in South African primary mathematics classrooms (Hoadley 2011)

The elaboration framework also offers categories within each of the three situations of contingencies, and how VSR interviews can be used as a tool for reflection and supporting teaching development. So, when the preservice teacher is done with the lesson, the researcher identified the three situations of contingencies and get to sit with the teacher to watch the lesson and reflect on the teacher's decision making. This provides the pre-service educators with an opportunity to question their content knowledge and to reflect on their responses to children's contributions in the classroom.

It is interesting to note that this framework was developed in the South African context making it much suitable to be use in this study. I intend to use the framework to identify the

contingencies in the classroom, analyse the teacher's response to the situation, and assess the extent of quality of teacher’s responses in relation to opportunities for student learning

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter outlines the research design and methodology employed in the study, detailing the systematic approach taken to investigate the research questions. It begins by describing the research design, then context and participants, specifying the setting in which the research was conducted and the criteria for selecting participants. The data sources are then identified, encompassing lesson observations and VSR interviews with each participating teacher. The chapter further elaborates on the data analysis techniques utilized, explaining how the data were interpreted and coded. Ethical considerations are thoroughly addressed, highlighting how informed consent, confidentiality, and anonymity of the participants were safeguarded throughout the research process. Finally, the trustworthiness of the study is established by discussing credibility, transferability, dependability, and confirmability of the findings.

3.2 Research Design

A case study research design was employed in this study. "A case study is described as an intensive, systematic investigation of a single individual, group, community, or some other unit in which the researcher examines in-depth data relating to several variables" (Heale & Twycross, 2018). Specifically, an intrinsic case study design (Stake, 1995) was adopted because the focus was on gaining deep, contextualized insight into how pre-service teachers responded to and reflected upon contingent moments in real classroom settings. Rather than aiming to generalize findings to a broader population, this design sought to understand the phenomenon itself, how novice teachers adapted spontaneously to unexpected classroom events and subsequently reflected on their decision-making. The intrinsic case study approach was particularly suitable for exploring these complex, real-life teaching interactions and for uncovering nuanced differences in practice and reflection that may not be captured through broader, quantitative designs such as surveys or experiments.

3.3Context of the study and Participants

Three pre-service primary mathematics teachers from one University in South Africa were purposively selected to participate in this study based on their academic performance in mathematics content and pedagogy courses. The study took place during their teaching experience in the 3rd block of the academic year (July to September 2023)

The mathematical structure for pre-service primary at this University is set up as follows: in the first year, students take a content-focused course on number related concepts; in the second year, they take a content-focused course on measurement and geometry; in the third, a course on the pedagogy of the first year's content is offered; and in the fourth, a course on the pedagogy of the second year's content is offered. This study focuses on the intermediate phase, and the participants were purposively selected based on their performance in the second and the fourth-year courses.

This selection aimed to capture a range of mathematical proficiency. Two students obtained low marks between the range (50 – 65%) and one had high attainment marks between the range (80% and above) in both second- and fourth-year courses. This variation allowed for the comparison of how differing levels of content knowledge influence responses to contingent moments.

Data source

Each participant was observed across three sequential mathematics lessons, resulting in a total of nine observed lessons. Observing multiple lessons per participant ensured adequate opportunities to capture contingent moments, as some lessons naturally included fewer unplanned learner contributions or misconceptions. This design enhanced the robustness of the data and allowed for a richer analysis of patterns in responsiveness across different instructional contexts.

Each preservice teacher provided a copy of the planned lesson and took the copy after the lesson. This is because the teacher might deviate from their planned agenda, it is thus important for the observer to know what the teacher had planned so she may know when the lesson has deviated. A preliminary analysis of the lessons was conducted to identify incidents of contingency based on the elaboration framework (Abdulhamid & Venkat, 2018) and prepare a semi structured interview questions to engage with the teacher in a context of one-on-one VSR interviews. The purpose of this interview was to gain insights on the teacher's decision making in response to contingent moments and to allow teachers to reflect on their practices. The interviews lasted for about 45- 60 minutes and took place outside the school hours at either on university campus or at the school where the pre-service teacher was placed. Overall, the data set included video clips of lesson observations, copies of lesson plans and audio recordings of the VSR interviews.

3.4 Data analysis

There were two phases of data analysis. First is the analysis of the lesson observations, and second, is the analysis of the VSR interviews.

3.4.1 Analysis of the lesson observations

All incidents of contingencies according to the elaboration framework (Abdulhamid and Venkat) were identified as unit of analysis in this study. These incidents are either of breakdown, sophistication, individuation or collectivizing. Each incident was transcribed, and a narrative was produced.

Weston's framework was used to code the quality of teacher's responses within each of the unit of analysis. According to Weston (2013) a teacher's response to a contingency moment was either coded 'appropriate or inappropriate'. When teachers attain to unexpected learner offerings that presented possible learning opportunities, the reaction is coded as "appropriate." In contrast, "inappropriate" included teachers disregarding or rejecting learner offers that had the potential to be educational, which hampered students' access to mathematics "in the moment".

If a response is classified as "appropriate," it was then coded at three levels: "minimum," "middle," or "maximum." Teacher responses are coded as minimal if there is an error or ambiguity in the teacher's response. The teacher response was coded as middle, if the teacher response had the opportunity for learning but there is limited follow-up questioning of the learner's suggestion. When a teacher provides a thorough explanation based on the unexpected learner offer and pressed the learner, it was clear that the situation had been used to its full potential. This was coded as maximum. Figure 1 provide a summary of the analysis of quality of teacher responses based on Weston's (2013) coding protocol

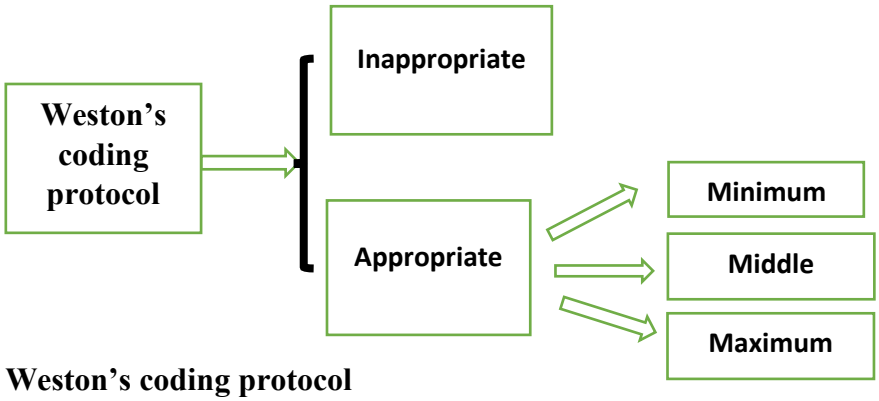

Figure 1: Weston's coding protocol

3.4.2 Analysis of VSR interviews

The VSR interviews was analysed using Geiger's et al, (2015) two dimensional framework that offers an effective tool for VSR interview analysis. Its main goal is to spot and keep track of changes in teachers' state of awareness and levels of reflections (Abdulhamid, 2022). While this study is interested in learning more about how the preservice primary school teachers' respond to and reflect on contingency moments, the idea is to also encourage teachers to become conscious of their methods, actions, responses and to consider whether they are genuinely serving their students' interests.

The first dimension of the framework outlines three hierarchical levels of reflections. (I) Technical reflections, where the teacher frequently concentrates on technical elements without considering the importance of the experiences while giving general reports of classroom activities. (ii) Deliberate reflections, a teacher notes "critical incidents" and provides a justification or explanation for the deed or behaviour. (iii) Critical reflections, in which a teacher goes beyond naming "critical incidents" and explaining them to considering other people's viewpoints and proposing solutions The second dimension outline the object of reflects, as it pertains to self, practice and students. Table 1 provides summary of the two-dimension framework.

Table 1 Two dimension framework for the analysis of VSR interviews (Geiger's et al, 2015)

Levels of reflection	**Object of reflective response**		
	Self	**Practice**	**Students**
Technical	Personal role is described during a teaching event. The description is factual rather than personally insightful.	Teaching practice is described in terms of technical aspects. Focus is on consequences or outcomes of their practice.	Students' responses to teaching activity are described in terms of technical aspects. Focus is on Focus is on consequences or outcomes of teaching practice.

Deliberate	Personal role is described during a teaching event. A rationale or explanation for the personal behaviour is provided.	Critical incidents are related to teaching practice, and a rationale or explanation for the practice is articulated.	Students 'responses to teaching activity are noted, and a rationale or explanation for the response or behaviour is constructed.
Critical	Personal role is described during a teaching event. The behaviour is critically analysed and alternative behaviours discussed.	The purpose of an activity is clearly articulated, and a judgement is made about the success or otherwise of a teaching practice. When unsuccessful, an alternative practice or activity is suggested.	Students 'responses to teaching activity are noted, and a rationale or explanation for the response or behaviour is constructed. Potential improvements to the activity are related to an anticipated student response.

3.5 Ethical considerations

For every study that involves human participants the issue of ethical conduct is very important. This is to ensure that participants are well protected in the study. To ensure ethical conduct in this study, I applied for ethical clearance from the Wits School of Education as well as GDE. Each pre-service teacher was provided with information sheet that detailed all what it required for one to participate in the study, including the kinds of data that was collected. Participants were required to sign a consent form.

A permission letters was given to each school where the preservice teacher was conducting their teaching experience. The fact that the study was conducted in primary schools, and it involves lesson observation, all learners were provided with information about the study and were required to sign ascent form. All these learners were minors and hence vulnerable. Their parents or guardians were also required to give consent for their children to participate in the study (See Appendix A for sample of the information letters and consent forms). Both Wits School of Education ethical clearance and GDE ethical approvals were granted prior to the commencement of the data collection.

3.6 Trustworthiness of the study

Trustworthiness is one-way researchers can persuade themselves and readers that their research findings are worthy of attention (Lincoln & Guba, 1985). To complement the traditional quantitative assessment criteria of validity and reliability, Lincoln, and Guba (1985) added the criteria of credibility, transferability, dependability, and confirmability to the concept of trustworthiness.

3.6.1 Credibility

Guba and Lincoln (1989) claimed that the credibility of a study is determined when coresearchers or readers are confronted with the experience, they can recognize it. Credibility addresses the "fit" between respondents' views and the researcher's representation of them. Therefore, for this study, credibility was demonstrated by collecting data, constant observations, as well as through the engagement with the teacher, for the study to ultimately be persuasive and true to the reader.

3.6.2 Transferability

The researcher cannot know the sites that may wish to transfer the findings; however, the researcher is responsible for providing thick descriptions, so that those who seek to transfer the findings to their own site can judge transferability (Lincoln & Guba, (1985). If anyone wishes to use or apply the research findings of this study on another context of study, they are welcomed to just if they state whose work, it is.

3.6.3 Dependability

When readers are able to examine the research process, they are better able to judge the dependability of the research (Lincoln & Guba, 1989) To ensure dependability, the researcher was record the study so that it may be tracked down by anyone with an interest. My supervisor also audited the study to determine whether the written material and research findings are reliable, and constant.

3.6.4 Confirmability

Confirmability is concerned with establishing that the researcher's interpretations and findings are clearly derived from the data, requiring the researcher to demonstrate how conclusions and interpretations have been reached (Tobin & Begley, 2004). Based on Guba and Lincoln (1989) confirmability is attained when credibility, transferability, and dependability are all met. Therefore, because they are intertwined, ensuring that my study has credibility, transferability, and dependability also entails ensuring that confirmability is attained.

CHAPTER 4: ANALYSIS AND FINDINGS

4.1 Introduction

This chapter presents the analysis and findings of three pre-service teachers (PSTs) responses to and reflections on contingent moments in mathematics teaching at the intermediate phase level. Three PSTs were chosen purposively from the university's fourth-year system to participate in this study. One PST had been receiving high grades in the region of 80% and above, while two had been receiving middle to low marks in the range of 50 to 65% in the mathematics content and methodology modules. Every participant was assigned to a different primary school located in different Johannesburg areas. Each participant's case profile is provided below. I used pseudonyms to keep the identity of the participant private.

In presenting the analysis, I first identified contingent moments from the video recording of the pre-service teachers using the elaboration framework (Abdulhamid and Venkat, 2018), as either breakdown, sophistication, individuation or collectivization. I then examine the quality of the responses in more depth using the Waston's (2013) coding protocol (minimum, middle and maximum). If a response is classified as "appropriate," it was coded at three levels: "minimum," "middle," or "maximum." Teacher responses are coded as minimal if there is an error or ambiguity in the teacher's response. The teacher response was coded as middle, if the teacher response had the opportunity for learning but there is limited follow-up questioning of the learner's suggestion. When a teacher provides a thorough explanation based on the unexpected learner offer and pressed the learner, it was clear that the situation had been used to its full potential. This was coded as maximum.

Subsequently, I present the analysis of the VSR interview with the participant to ascertain the types of reflections that the pre-service primary school teacher offers regarding contingent moments. I first presented the context of the contingent moments, followed by the teacher's response. Then, I provided a commentary on the findings, guided by Geiger et al.'s (2015) two-dimensional framework, which examines the object and level of reflections.

4.2 Analysis and findings of Case studies

4.2.1 The case of Baya

Ms Baya assigned to teach fourth graders in a primary school at Alexandra. There are 64 learners in Ms Baya's class. Ms Baya is in her 4th year in the university studying to become an intermediate mathematics teacher, and she has attaining grade in the range (50 -60%) in her mathematics content and methodology courses. Three of Ms Baya's lessons were observed.

The first lesson focused on 2-D shapes, the second lesson on viewing objects and the last lesson focused on Data handling. Table 2 provides a summary of the levels of quality of Baya's responses to contingent moments in the three observed lessons.

Table 2 Summary of analysis of Baya's quality of responses to contingent moments`

Lessons	**Levels**				**Total**
	Maximum	Middle	Minimum	Inappropriate	
Lesson 1 (2 D Shapes)	1	1	1	1	5
Lesson 2 (Viewing objects)	1	0	0	2	3
Lesson 3 (Data handling)	0	0	0	1	1
Total	2	1	1	4	8

Table 2 shows the overview of the coding of Ms Baya's three lessons. The table indicated a total of 8 contingent episodes coded across the 3 lessons. There are more episodes in lesson 1, and less in lesson 3. There is a total of 2 maximum, 1 Middle, 1 minimum responses, with 4 inappropriate responses. I conclude that although 2 out of Baya's 4 responses were coded at the maximum level, the presence of 4 inappropriate responses led me to determine that Baya's overall responses to contingent moments were low. In what follows, I present a qualitative analysis of selected episodes as telling cases to illustrate Ms Baya's responses to contingent moments.

4.2.1.1 Ms Baya's Lesson 1

Towards the middle of Ms Baya's lesson 1, she asked learners to explain the 2-D shapes. The following episode details the interaction between Ms Baya and learners in the class.

1. *Teacher: So, today we will talk about 2D shapes, who can give me an example of 2D shapes. Raise your hands and I will pick you up.*
2. *Teacher: reiterating…examples of 2d shapes.*
3. *Learner: 2D shapes has both sides straight hides her face)*
4. *Teacher: (smiling) yes guys it is that Clap hands for her*
5. *Teacher: Who can also tell me examples of 2D shape? …. Examples*
6. *Learners: quiet….*
7. *Teacher: okay, Khanindixelele ke ngama shapes eniwaziyo (Tell me about all the shapes you know)*
8. *Learner: Triangle*
9. *Teacher: A triangle, good. Points at another learner, yes*
10. *Learner: Nxantathu, smiling, yes guys niyawazi mos. (you know them)*
11. *Teacher: Yes, points at another learner*
12. *Teacher: Square*

13. *Teacher: Yes, we have a triangle, square what else?*
14. *Learners: Rectangle, pentagon, pentagon, (learners chorusing)*
15. *Teacher:*

The teacher wants examples of 2D shapes the learners know, one learner comes in to say *"2D shapes has both sides straight*…." The teacher goes on and says, *"yes that's it guys," and applauded the learner, however, the teacher moves on asking again example of 2-D shapes*. The fact that 2-D shapes are polygons, which are straight lines, this may be the reason why the teacher did not reject the offer, however the move to another learner with emphasis on 'examples' (see line 5) indicates teacher's lack of satisfaction with the learner's offer. This can be coded **appropriate**, the level of appropriate is coded as **middle** because the teacher's response had the opportunity for learning but there was limited follow-up questioning of the learner's suggestion.

Furthermore, seeing that the learners were not responding to the question "who can give me an example or examples of 2D shapes". The teacher then restated her question and asked in home language (iSiXhosa); khanindixelele ngazo zonke ii shapes enizaziyo, meaning – "*tell me about all the shapes you know*". The learners started chorusing square, rectangles… Here the code-switching offers more clarity to the question being asked by the teacher, what Abdulhamid and Venkat (2018) refer to by verbal reframing, meaning through the use of alternative phrase as an elaborated responses that support quality classroom interactions. In this case, it is code-switching. This act is therefore coded **appropriate (Maximum)** because, she realized that her learners were not responding to what she had planned, perhaps she may have assumed that the learners already knew what the term (2D) meant and which shapes to remember when asked about 2D shapes. When she realized that the learners were unfamiliar with the term "2D shape," she departed from her original plan and asked the same question in a different way, and in home language.

It is interesting to note that one learner offered Triangle, and another said "Nxantathu". Nxantathu, meaning a triangle in English. However, the teacher accepted the offer and moved on. It is therefore unclear whether the learner that offers "Nxantathu" did not hear the offer of a triangle, or he simply do not know that "Nxantathu" is a triangle. I see this as a missed opportunity from the teacher to further probe the learner offer. Considering the context of grade 4 classroom in a township setting, that they had just begun to be taught in English as the language of teaching and learning (LoTL). The lack of the teacher's response can be seen as **inappropriate response.** This is a case where the teacher misses important teaching point, as

it was reported that Grade 3 learners come to grade 4 lacking mathematics language proficiency (Mzimazi, 2021).

Rowland and Zazkis (2013) concluded that "a teacher's response to problematic contingent moments that arise in teaching mathematics are fundamentally dependent on their mathematical knowledge, which prompts and guides pedagogical implementation" (p. 151). When teaching mathematics, the teacher's subject-matter is crucial. When the teacher here said that the textbook was an example of a square, this is a slippage that may have consequences to mathematical learning, as the textbook shown has a rectangular shape. Perhaps, the teacher uses an opportunity to incorporate an example of a 2D shape with resources available in the class. This incident therefore is an **appropriate** response because she improvised on an unplanned moment, but because the teacher's response had an ambiguity or slippage then it was coded **minimum.** Contingency moments according to (Aytekin & Bostan, 2019) is associated with the codes of "responding to students' ideas; deviation from agenda; teacher insight; (un)availability of resources". So, in the absence of resources the teacher decided to use the textbook in her disposal, which is something she did not plan.

4.2.1.2 Ms Baya's lesson 2

The teacher instructed the learners to look at page 124 in the mathematics textbook called platinum. The following episode details the interaction between Ms Baya and learners in the class.

1. *Teacher: What are viewing objects*
2. *Learners: quiet…*
3. *Teacher: What are viewing objects guys? …*
4. *Teacher: What views do you know on objects?*
5. *Learners: still quiet…*
6. *Learner: What are views or viewing objects ma'am?*
7. *Teacher: You will hear when we are doing the examples. She then took a textbook and pointed at the cover of the textbook then asked, what view is this? (The book was sitting on top of the table facing the top.*
8. *Learner: It is a top view.*
9. *Teacher: No, it is not. She went ahead and said this is the front view. She then continues to ask for other views.*
10. *Teacher: Andithi, you learnt from Geography that there is a key?*
11. *Learners: Yes,*
12. *Teacher: Do you guys know what a key is? What is a key?*
13. *Learner: A key is a key word; another learner said a key is a map…*
14. *Teacher: What is a map then?*
15. *Teacher: a key is something that helps you to see things on the map.*

One of the learning objectives listed on the teacher's lesson plan was for learners to be able to know what viewing objects means by the end of the lesson. The teacher asked, "What are viewing objects?" The learners said nothing. She continued to ask questions regarding views and the learners were still quiet and at one point a learner inquired what viewing objects are to the teacher. The teacher continued with the lesson despite having noticed that the learners were not familiar with the subject and had been asked to define viewing objects but did not. In response to unexpected students' ideas, a teacher can choose, "to ignore, to acknowledge but put aside, and to acknowledge and incorporate" (Rowland et al., 2015, p. 79). The lesson proceeded with the expectation that she would explain the concept of viewing objects, but she did not. The lesson's purpose was not achieved; so, this can be classified as **inappropriate** because a crucial educational element was omitted by the teacher.

Erroneous responses from learners suggest a lack of understanding of the material being studied. It indicates the need for the teacher to go into further detail on the subject. The incorrect response she received when she inquired, "What view is this?" was that it is the top view. The teacher did not ask why the student believed that this was the best viewpoint. What qualities distinguish a top view?... By doing this, she is putting the student at the centre of the class and letting them make mistakes to grow. This is a coded **inappropriate** as well because it eliminated all opportunities for learners to learn more about the subject. However, realizing that the learners were unfamiliar with the key in mathematics, particularly in viewing objects, the teacher strayed from what was planned for the lesson and inquired about a key they had learned about in geography. She followed up to inquire further about their answers regarding a map and then provided a comprehensive description of the main idea of the topic, this was **appropriate** contingency and coded **maximum**.

4.2.1.3 Ms Baya's Lesson 3

Data handling

1. *Teacher: today we will learn about data handling, who can tell me what data handling is?*
2. *Learner: Quiet….*
3. *Teacher: come on guys, what is data handling?*
4. *Learner: Phones, you punch in airtime.*
5. *Teacher: data handlining is something that we measure and record.*

There aren't many unexpected moments in this lesson. except for one when the teacher enquired as to what data handling is, and the students stated, "It's what you punch in airtime." They confused the term "data" with "data bundles." The teacher did not clarify the difference. It is

unknown though whether the teacher did not feel there was a need to clarify the difference, or she simply did not take the response into consideration or in need for more clarity. This can be seen as **inappropriate** because students who misunderstood data did not have the chance to learn from their error, misconception. This could have been cleared up, clarified because ultimately the learner was not wrong with the answer just that the teacher was not referring to the same data the learner thought the teacher was asking. I see this as a missed opportunity as the teacher had the chance to go deeper and clarify the differences so that students in the following grade would understand exactly what data handling is and how it differs from data bundles and their various pronunciations.

4.2.1.4 Findings from Baya's VSR interview

To analyse the VSR interviews, Geiger's et al, (2015) two dimensional framework was used. It offers an effective tool for VSR interview analysis. Its main goal is to spot and keep track of changes in teachers' state of awareness and levels of reflections (Abdulhamid, 2022).

I met with the preservice teacher, Baya after having analysed her lessons and engaged her in a conversation after we both watched selected episodes from her lesson together. I began the interview with a more generic question about the goal of the lesson and whether Ms Baya felt she achieved the stated goal.

Baya responded in the following way

"As a teacher, you always plan and thoroughly prepare for your lesson but then things don't always turn out as planned, hiccups and disruptions leave us with no choice but to deal with what comes. Hence, I don't believe I totally achieved the objectives set up for my lesson"

Baya's response indicated technical reflection about practice since her attention was around the hiccups and disruptions that teachers face during the mathematics lesson. It is coded as technical description because she did not pay attention to the mathematical details related to the hiccups and disruptions she mentioned.

Moving into the specific contingent episodes in her lessons,

During her lesson, Ms. Baya posed a question to the entire class: *"What is data?"* In response, one learner answered, *"Phone, you punch it in."* Rather than engaging with this answer, Ms. Baya chose to proceed with her lesson without acknowledging the learner's contribution.

When questioned during a Video Stimulated Recall (VSR) interview about why she chose to ignore the learner's response, Ms. Baya explained:

"I intentionally ignored the learner because attending to her would have derailed my lesson. I wanted to stick with the lesson and addressing that response would have made me deviate from the original plan."

Ms. Baya's explanation aligns with my earlier coding of this episode as *inappropriate*. Her deliberate decision to adhere strictly to the lesson plan, despite a learner's attempt to engage, suggests a lack of responsiveness to her students' needs. This indicates that Ms. Baya prioritizes content delivery over fostering a flexible, student-centred learning environment where learners' ideas are valued and explored, even when they diverge from the planned trajectory.

The teacher then asked, what is a 2D shape? One student responded that "a 2D shape has both lines straight." She stated, "That's it, guys," and continued with the lesson.

When questioned during the VSR interview about why she chose to respond the way she responded to the learner's offer, Ms. Baya explained:

"Since a 2D shape does have straight lines and some lines are equal, I felt at that time that the response didn't need any elaboration but now watching the lesson, I realise that my response has some limitations. I think it would have been better if I had asked one student to draw a 2D shape on the board so I can elaborate on the learner's response about the straight lines.

After she watched her video recordings right before my interview, she displayed indications of awareness, acknowledging limitations in her response and the things she could have done differently. This response displays a change from a technical to a deliberate level of reflection about learners and self. Instead of defending her errors and, as she put it, "brushing things off," she realized that there were many things she could have done differently especially in this instance that would have improved the lesson. Ms Baya provides depth reflection on the value of VSR interviews:

"The interview opened my eyes to the things we typically do in class, which sometimes seem fine, but in reality, it turns out that they are not providing adequate explanations and are not doing justice to some students in the class".

Baya's responses indicated some sort of self-awareness moment, and she acknowledged some limitations in her response to contingent moment. This was made possible because of the interactions in the context of VSR interviews.

4.3.1 The case of Ms Zukelwa

Ms Zukelwa also assigned to teach fourth graders in a primary school at Johannesburg. There are 49 learners in Ms Zukelwa's class. Ms Zukelwa is in her 4th year in the university studying to become intermediate mathematics teacher, and she has also demonstrated middle performance in all her mathematics content and methodology courses. Three of Ms Zukelwa's lessons were observed. The first lesson focused on Time, the second lesson was the continuation of time, and the last lesson focused on telling time.

Table 3 provides a summary of analysis of Ms Zukelwa's quality responses to contingent moments in the three observed lessons.

Table 3: Summary of analysis of Ms Zukelwa's quality of responses to contingent moments

Lessons	**Levels**				**Total**
	Maximum	Middle	Minimum	Inappropriate	
Lesson 1 (Time)	0	1	0	0	1
Lesson 2 (Time)	0	0	0	1	1
Lesson 3 (Time)	0	0	0	0	0
Total	0	1	0	1	2

Table 3 shows the overview of the coding of Zukelwa's three lessons. The table indicated a total of 2 contingent episode across the 3 lessons. There is a total of 0 maximum, 1 Middle, 0 minimum responses, with 1 inappropriate response. Ms Zukelwa's overall responses to contingent moments lead me to believe that contingencies in her lessons were low.

In what follows, I present a qualitative analysis of selected episodes as telling cases to illustrate Ms Zukelwa" s responses to contingent moments from lesson 1 and 2. No example is presented from Lesson 3 since there was no evidence of content moment

4.3.1.1 Zukelwa's lesson 1

In her first lesson about Time, Zukelwa's interactions with her leaners is presented below:

1. Teacher: So, today I have brought you something. Who can tell us, what this is?

   referring to a watch. What is this?

2. Learner: This is an analogue clock.
3. Teacher: This is a, while learners are saying analogue clock, the teacher was emphasizing it is a clock So; what do you think we are going to talk about today?
4. Learner: Time.

On the above illustration the teacher did a good job in refocusing learners' attention to the right direction. She realised that the learners were referring to the instrument as an analogue clock, and as they were saying analogue clock, she kept on saying 'this is a clock' and then ask them, 'this is a'? until the learners changed and said, it's a clock teacher. This shows that the teacher was not satisfied with the response from the learners and tried to bridge the gap. This therefore is an **appropriate** response to contingency moments, because she realised that there's a misconception of saying an instrument of time an analogue clock and emphasised the right terminology, without a lot of diverting from the original lesson. As much as the response to contingency is appropriate, it is coded as **middle**, because the teacher's response had the opportunity for learning but there was limited follow-up questioning of the learner's suggestion. According to Rowland on factors that triggers contingencies, this contingency was triggered by the students. Their response had a misconception, and the teacher had to chip in and correct the misconception in passing, without diving in deep.

4.3.1.2 Zukelwa's Lesson 2

The teacher was not done with the lesson from the previous day, so she continued.

1. Teacher: Last time we spoke about time, which time o'clock did you speak about?
2. Teacher: Which time o'clock did we speak about?
3. Learner: We learnt about an analogue
4. Teacher: Today we will talk about digital clocks which work with numbers.
5. Learner: What is the difference between analogue and digital clock ma'am?
6. Teacher: is there anyone that can answer that question?

   Learners: …quiet

7. Teacher: Let us focus on what I was saying, we will come back to the question later. We

   are focusing on digital clocks and digital clocks work with numbers.

The teacher here blatantly ignored the learner's questions. This learner asked the teacher a question she had not expected, this shows a moment of contingency. The learner asked, what is the difference between an analogue and digital clock.? This moment of contingency was triggered by the learner and the teacher asked learners to respond, when they couldn't, the

teacher decided to continue with the lesson. This contingency is an example of an **inappropriate** response to contingency moment. According to Weston (2013) "inappropriate" include teachers disregarding or rejecting learner offers that had the potential to be educational, which hampered students' access to mathematics "in the moment".

4.3.1.3 Findings from Zukelwa's VSR interview

After analysing Zukelwa's lessons, I met with her and engaged in a conversation after we both watched selected episodes from her lesson together. I began the interview with a more generic question about the goal of the lesson and whether Ms Zukelwa felt she achieved the stated goal.

Zukelwa responded in the following way

"Not all the time, because sometimes you come to class, especially with grade 4's, assuming they know what you are about to teach. So according to your ATP, you are supposed to teach a certain topic at a certain time. But when you get there, sometimes you find out they don't even have a background of what you are teaching them, or they forgot. Then as a teacher, I am obviously forced not to start where I had intended to start with my lesson that I had planned. So, I need to first teach them a brief background and then teach them what I thought they know already."

Then how do you normally deal with all the things that come up unexpected during the lesson or before the lesson.?

"As a student teacher, I typically don't have a lot of background knowledge of the learners. I always assume they are already familiar with the content. Once I discover that they are unaware. Then am forced to consult my resources, which makes it difficult for me because I didn't plan the lesson the way it's going now, and it takes a lot of time that I don't even have to go back and consult the resource. So, as a student teacher, this disturbs me because I had only prepared what I was going to teach."

Zukelwa's response indicates technical reflection about self and practice since her attention was around how deviating from the lesson planned affects the time allocated for that lesson and her as a student teacher. She described the teaching event as a personal inconvenience. Additionally, the teacher described teaching practice in terms of technical aspects. Focus is on consequences or outcomes of their practice, how not attending to the lesson the way she had planned is going to affect time given to her which ultimately makes her behind with work and will have to use her personal time, to work overtime to catch up. Her answers are coded as

technical descriptions because they focus entirely on how the entire process of deviating from a planned lesson makes it difficult for the teacher to deal with the practice, rather than how going back and giving the kids the mathematical prior knowledge will help them understand the lesson very well even though it wasn't part of the original plan.

Moving into the specific contingent episodes in her lessons,

Ms Zukelwa re-iterated in her lesson repeatedly, “this is a clock” while learners were saying it’s an analogue clock.

When questioned during a Video Stimulated Recall (VSR) interview about why she chose to respond the way she responded to the learner's responses, Ms. Zukelwa explained:

‘I think I wanted them to understand that we have two types of clocks, so not every clock that they see is an analogue clock. In so they must know that these are instruments of time. They are both clocks and then after having clocks then there is analogue clock and then there is digital clock but then they are not both analogue clocks.’

This response from Ms Zukelwa is still seen as an appropriate response and a deliberate reflective response to students (VSR), the teacher response to the teaching and the rationale for the response is constructive. She deliberately corrected her learners making a mistake. She realized that her learners have a misconception and although she did not plan for it, she still quickly delt with it without deviating a lot from her initial plan.

What is the difference between an analogue and digital clock? a learner asked. She responded and said, they will come back to the question later.

Upon being asked about this incident, she argued that:

“Because of time, I didn’t want to delay what I had planned by deviating but I wanted to go according to plan and if I had attended to the question, I wouldn’t have been able to finish the lesson.”

This appears to be technical reflective response of practice; the focus is on outcomes of the practice. The teacher still stood that nothing better could have happened any differently even if she were to repeat the lesson. This indicates an oversight from the teacher’s perspective on the impact of tabling concepts down for learners to understand gradually the lesson and move in sync with the lesson.

However, at the end of the lesson he argued, *"Now that I'm talking to you, I'm thinking that whenever I'm about to do a lesson. I don't need to only prepare what I plan to teach that day. I also must familiarize myself with a background knowledge, so that should anything arise unexpected, I know that at least like am prepared and ready for that."*

This concluding statement from the teacher indicates self-awareness. She wants to prepare more now and prepare herself for things that might arise unexpectedly during the lesson. She is aware of the mistakes she made and wants to make things better for the learners in her next lessons. This then indicates that the teacher moved from unconsciousness to consciousness. This was made possible because of the interactions in the context of VSR interviews.

4.4.1 The case of Mr Luphiwo

Mr Luphiwo assigned to teach Grade 5's in a primary school at Johannesburg. There are 51 learners in Mr Luphiwo's class. Mr Luphiwo is in her 4th year in the university studying to become intermediate mathematics teacher, and he has also demonstrated strong performance in all her mathematics content and methodology courses. Three of Mr Luphiwo's lessons were observed. The first lesson focused on comparing and ordering length, the second lesson on 2D shapes and the last lesson focused on regular and irregular shapes, a continuation of lesson two.

Table 4 provides a summary of the Luphiwo's quality responses to contingent moments in the three observed lessons.

Table 4: Summary of analysis of Mr Luphiwo's quality of responses to contingent moments

Lessons	**Levels**				**Total**
	Maximum	Middle	Minimum	Inappropriate	
Lesson 1 (Comparing length)	2	0	0	0	2
Lesson 2 (2D shapes)	2	0	0	0	2
Lesson 3 (Irregular shapes)	1	0	0	0	1
Total	5	0	0	0	5

Table 4 shows the overview of the coding of Luphiwo's three lessons. The table indicated a total of 5 contingent episodes coded across the 3 lessons. There are more episodes in lesson 1 & 2, and less in lesson 3. There is a total of 5 maximum, 0 Middle, 0 minimum responses, with 0 inappropriate responses. I conclude that the presence of Mr Luphiwo's quality responses at maximum level (5) is leading me to conclude that Luphiwo's overall responses to contingent

moments were very high. In what follows, I present a qualitative analysis of selected episodes as telling cases to illustrate Mr Luphiwo's responses to contingent moments.

4.4.1.1 Mr Luphiwo Lesson 1

The pre-service teacher's lesson Mr Luphiwo was on **comparing length**. Interactions with his leaners is presented below:

1. Teacher: We are going to compare and order length. Before we start with our lesson, let us go back a little. What do you understand about length, what is length?
2. Learner 1: length is how far from a distance is.
3. Learner 2: Length is everything we measure.
4. Learner 3: Length is the distance between two objects from one place to another.
5. Teacher: So, leaner three says, length is the distance between two objects, from one place to another. For example, let us say I decide I want to go to Pretoria. From here to Pretoria, if we were said to measure the distance. Which units are we going to use to measure the distance?
6. Learners: Kilometers
7. Teacher: how do we convert from mm to m?
8. Learner: We multiply
9. Teacher: asking the class, do we multiply?
10. Learner: No, we divide.
11. Teacher: How are we going to divide?
12. Learner: we divide by one thousand.
13. Teacher: Now, who can tell me, how do we convert from cm to m?
14. Learner: We divide by one hundred.
15. Teacher: from cm to mm?
16. Learner: We are going to multiply.
17. Teacher: Why are we multiplying
18. Learners: because cm are bigger than mm.
19. Teacher: in other words, we are converting from bigger to smaller

In the beginning of the lesson the teacher says, "We are going to compare and order length. Before we start with our lesson, let us go back a little. What do you understand about length, what is length? This was not on the lesson plan. The mere fact that the teacher saw a need to 'go back a little' before starting with the lesson shows a great deal of how adamant and enthusiastic his work is. The act of going back a little is called checking the learner's prior knowledge. It is an essential element that teachers need to do to gauge where the learners are, so the lesson can move forward in sync. According to schema theory, prior knowledge is a critical factor in forming a new cognitive schema to gain new knowledge (*Bartlett., 1995*). Some teachers tend to assume that learners know, and in that assumptions a lot of learners are always left behind. Because the teacher did not plan this but felt the need to start by going back shows an example of an **appropriate** contingent moment and is coded **maximum**. This is because while the teacher was engaging with the learners trying to get their prior knowledge a

lot of learning took place. He closed a lot of gaps and misconceptions which made the lesson more understandable for the learners.

In the above lesson, the teacher demonstrated a great deal of **appropriate** responses to contingency moments. He literally, probed further didn't leave anything out. When he was teaching how to convert from one measuring unit to the other, he asked, 'why do we multiply' and a learner answered because 'cm are bigger than mm'. as much as he explained that 1cm is equivalent to 10mm and that when you convert from bigger to smaller units you multiply, he needed to make sure that the learners also understand why they multiply and why they divide. This also is a contingent moment because it was not planned, the teacher felt the need to re iterate and ask questions repeatedly to check for understanding. It is not known if he was anticipating that they're not following or just needed to make sure that the learners are following but this was coded **maximum** because of the questions he kept on provoking for better understanding on the learners and to make sure that no learner is left behind. The teacher further taught everything in his lessons in details. The questions were tackled appropriately in detail, allowing students to understand deeper and to unlearn their misconception. He also used projectors, which had videos explaining further what he just taught the learners. He placed learners in groups to talk about question he had probed and allowed them to give their feedback. All his lessons were spot on.

4.4.1.2 Mr Luphiwo Lesson 2

The pre-service teacher's lesson Mr Luphiwo was on **2D shapes**. Interactions with his leaners is presented below. The teacher greeted the learners and asked them how they are.

1. Teacher: Today we are going to learn about 2D shapes, two – dimensional shapes. In Grade 4 you learnt about these shapes. What do you remember? Anything…
2. Learners: chorusing, a square, hexagon, pentagon, rectangle, …
3. Teacher: Thank you those are examples of 2D shapes.
4. Teacher: Can 5 kids come in front and each draw one example of 2D shapes?
5. Learners: They started getting up and going...

You learned about these shapes in grade 4. What do you recall? Once more, the teacher is attempting to grab the students' attention by finding out what they already know about the subject they are about to begin. This will allow him to decide whether to follow his lesson plan exactly or if he must remind the students by going back to Grade 4 work before beginning with his lesson. This clearly displays a coded maximum response that is appropriate. The students are brought up to speed by this question. All the students are at the same level as the next lesson begins. For those who had forgotten, they recall, and for those who don't know, they start to

think about these shapes and know them as other students are responding. Learning is already taking place, and students are left behind. The teacher then instructs the class to come forward and draw a couple of the two-dimensional shapes they can recall. Some students learn up knowledge through observation. They remember by observation. Because they are hands-on, children are more engaged with the lesson when drawing. In the end, this indicates that comprehension is taking place. Once more, this response is appropriate and coded maximum.

4.4.1.3 Mr Luphiwo Lesson 3

The pre-service teacher's lesson Mr Luphiwo was on regular and irregular shapes. Interactions with his leaners is presented below. The teacher greeted the learners and asked them how they are.

1. Teacher: Today we are going to talk about regular and irregular polygons. Before we do that lets go back a little. What do you know about polygons?
2. Learners: quiet ….
3. Teacher: no one knows, let me play you a video on polygons maybe it will jog your memory.
4. Learners: Listening attentively and waiting for the projector to play….

The utilization of a projector and playing a video for the students is an example of contingency moment. This is not in the lesson plan. The teacher improvised. This is an appropriate response. The teacher was unaware that the students would have no prior knowledge of polygons, so instead of beginning with the lesson, he showed them a video with the intention of jogging their memory. This response is also coded as maximal.

4.4.1.4 Findings from Luphiwo's VSR interview

I met with the preservice teacher, Luphiwo after having analysed his lessons and engaged him in a conversation after we both watched selected episodes from his lesson together. I began the interview with more generic question about the goal of the lesson and whether Mr Luphiwo felt he achieved the stated goal.

In his interview, Luphiwo made the case that teachers should not assume that the class will proceed according to plan; instead, he stated that unplanned moments must occur. *"As educators, we must so prepare in advance. Take a seat, consider potential misconception that might arise, and make plans for them."*

This statement from the teacher indicates a critical level of reflection. "Take a seat, consider potential misconceptions." The teacher plans for contingency moments. The behaviour is critically analysed beforehand, and alternative behaviours is discussed. The teacher

understands that not all lessons go according to plan; for learners to learn, they need to ask and be asked questions.

Moving into the specific contingent episodes in her lessons,

In your first lesson you said, '*We are going to compare and order length." Before we start with our lesson, let's go back a little. What do you understand about length, what is length'?*

Was there a specific reason for you to ask that because it is not in your lesson plan?

Mr. Luphiwo said as a teacher he believes every time he starts a lesson; he should assess where the learners are and not assume that they are at the level he wants them to.

"Firstly, we need to check whether they have learned and mastered the skill."

Mr. Luphiwo's response demonstrates a high degree of self-awareness and comprehension, as well as a keen understanding of what must be done in the classroom for students to ultimately acquire the skill. This then shows a critical level of reflective response of self, practice, and students. This is because classroom behaviour is critically examined, alternative behaviours are explored, the goal of an activity is stated explicitly, and the effectiveness of a teaching strategy is evaluated. Additionally, a different activity is introduced if the one which was planned becomes ineffective. A predicted student response is linked to possible improvements to the exercise. Mr. Luphiwo demonstrated a critical degree of reflective responses to oneself, practice, and students in each of his lessons.

4.5 Summary of findings across the case studies

Table 5 below provide the summary of the coded episodes across the three case study teachers: Ms Baya, Ms Zukelwa, and Mr Luphiwo.

Table 5: Summary of the cross-sectional analysis of the three case study teachers; incidents of contingency

PSTs	**Levels**				**Total**
	Maximum	Middle	Minimum	Inappropriate	
Ms Baya	2	1	1	4	8
Ms Zukelwa	0	1	0	1	2
Mr Luphiwo	5	0	0	0	5
Total	7	2	1	5	15

Fifteen contingency moments in all, across the three case study teachers, each coded at a different level, are displayed in Table 5. Interestingly, a classification of 5 inappropriate and 7 maximum responses throughout the lessons. This suggests that there is a fair likelihood that the pre-service teachers were able to respond to contingency moments more effectively than not. Rowland, Huckstep, and Thwaites (2005) describe contingency as an ability to respond to children's thoughts and actions and to deviate from a teaching plan or agenda as required. Some teachers still believe in the traditional way of teaching. The one where the teacher talks and learners listen without any questions, the teacher centred approach. Hence when they were questioned by learners, they resorted to ignoring the questions or contributions. While on the other hand, some teachers appreciate that times have changed, learners learn best when they are actively involved in the lesson. Therefore, responding to contingency moments also involves the right attitude and beliefs.

The individual-level data shows that Mr. Luphiwo is highly effective in responding to contingent moments, with 5 responses rated at the highest level and no instances of middle, minimal or inappropriate responses. His mathematical knowledge, based on content and methodology courses, falls within the 80% and above range. This further suggests that strong content and pedagogical knowledge enhance the ability to respond appropriately to contingent moments. While on the other hand, although 2 out of Baya's 4 responses were coded at the maximum level, the presence of 4 inappropriate responses reveals that Baya's overall responses to contingent moments were low. This was because Baya chose not to respond to a lot of contingency moments which were detected across her lessons. Ms Zukelwa's case only had few contingencies found in her lessons. This might be because Ms Zukelwa asked questions which lacked cognitive demand, compared to the other teachers. This then means chances of contingency moments to appear are low because nothing is challenging learners to think outside of the box or to even ask to follow up questions.

The VSR interview allowed Ms. Baya and Ms. Zukelwa a chance to examine their teaching skills. For instance, Ms. Baya watched all her lessons during the VSR interviews that were videotaped while she was teaching. Upon reflection, she realized that she had missed numerous opportunities to expand on the topics for better comprehension throughout her lessons. After that, she shared how she plans to improve her teachings moving ahead.

Overall, the findings highlighted different preservice teacher responses specifically related to the "contingency" dimension of the Knowledge Quartet, which concerns teachers' ability to adapt their pedagogy in response to unexpected moments during lessons. For instance, Ms. Baya demonstrated strong contingency skills by effectively using questioning to address a learner's error and adapt the lesson dynamically. Conversely, Ms. Zukelwa missed a clear opportunity to engage with a learner's alternative strategy, showing a lack of pedagogical adjustment despite an opening to do so.

During the VSR interviews, several pre-service teachers reflected on their challenges with contingency moments. Many admitted that limited content confidence made it difficult for them to deviate from planned lesson plans when unexpected questions or events arose. These reflections suggest that developing stronger contingency skills is essential for enabling teachers to respond flexibly and effectively to in-the-moment classroom situations. Teacher training programs in South Africa might need to focus more on preparing pre-service teachers for "in-the-moment" decision making, helping them build confidence and agility to respond to real-time challenges, rather than just following fixed lesson plans.

CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the study's research summary, findings, and recommendations. It starts by describing a summary together with the purpose of the study, problem statement, research questions, and methodology. The findings on each participant are then presented in this chapter, together with the findings that talks to each research question. furthermore, the findings' implications for practice and policy are examined and further developed. Finally, limitations and recommendations are discussed.

5.2 Summary of the study

The purpose of this study was to investigate how pre-service primary school teachers' respond to and reflect on contingency moments in the teaching of mathematics at the intermediate phase level. Specifically, the study aimed to achieve the following objectives.

1. To evaluate the quality of responses by pre-service primary school teachers to contingency moments encountered during mathematics teaching.
2. To analyse the types of reflections pre-service primary school teachers, provide on contingent moment incidents in the context of VSR interviews.

A qualitative case study was conducted with three participants who live across Johannesburg and who are in their 4th year studying education in one university in South Africa. These participants were then asked permission to observe them on how they respond and reflect on their contingency moments during their teaching practice. Weston's framework was used to code the quality of teacher's responses within each of the unit of analysis. According to Weston (2013) a teacher's response to a contingency moment was either coded 'appropriate or inappropriate'. If appropriate, the response was either coded minimum, middle or maximum. The VSR interview was used as a tool for reflection of own teaching, and a means for supporting teaching development. It is a collaborative conversation between the researcher and the teacher after watching episodes of teaching. The VSR interviews was analysed using Geiger's et al, (2015) two dimensional framework that offers an effective tool for VSR interview analysis. Its main goal is to spot and keep track of changes in teachers' state of awareness and levels of reflections.

5.3 Summary of the Key findings

Based on the cross-sectional analysis of the three case study teachers as detailed in chapter 4, the following key findings were revelled:

1. Variation in Responses to Contingency Moments

Pre-service teachers responded differently to contingency moments, with some demonstrating high adaptability and others struggling to engage. For example, Ms. Baya frequently ignored unexpected moments in her lessons, resulting in low overall response quality, despite having some high-level responses. In contrast, Mr. Luphiwo consistently responded at the highest level, showing strong engagement with unplanned classroom events.

2. Impact of Questioning on Contingency Opportunities

The nature of questions asked by teachers influenced the occurrence of contingency moments. Ms. Zukelwa's lessons had fewer contingencies, likely because her questions lacked cognitive demand. This suggests that lower-order questioning reduces opportunities for unexpected learner contributions, limiting the potential for contingent responses.

3. Content Knowledge and Effective Response to Contingencies

Teachers with strong mathematical content knowledge, such as Mr. Luphiwo, were better at responding effectively to unexpected moments. His ability to anticipate misconceptions and elaborate on students' ideas highlights the role of content expertise in handling unplanned classroom interactions.

4. The Role of Reflection in Improving Teaching Practice

The VSR interviews revealed that teachers who reflected on their lessons recognized missed opportunities to engage students. Ms. Baya, for instance, realized she could have used contingency moments to enhance learning but failed to do so during the lesson.

5.4 Implications of the findings to policy and practice

Based on the key findings discussed in the previous section, the following implications are presented based on policy and practice.

1. The rigid time frames set in the Annual Teaching Plan (ATP) may limit teachers' ability to respond effectively to learners' questions and unexpected learning moments. The Department of Education should consider revising ATP guidelines to allow more flexibility in pacing, ensuring that teachers can address learners' diverse needs without

feeling pressured to rush through topics. Additionally, teacher training policies should integrate explicit guidance on handling contingency moments to better prepare pre-service teachers for real classroom dynamics.

2. Teacher education programs and professional development workshops should place greater emphasis on preparing teachers for unexpected classroom moments. Training should include practical strategies for managing contingencies, such as how to anticipate learners' misconceptions, adapt lesson plans in real time, and leverage spontaneous learning opportunities. Universities and in-service training programs should incorporate case studies, video-based reflections, and micro-teaching sessions that focus on contingency moments to enhance teachers' adaptive teaching skills.

5.5 Limitations of the study

Based on the overall design and findings of the study, the following limitations are discussed.

1. The study was conducted with only three pre-service teachers, which limits the generalizability of the findings. A larger sample would provide a more comprehensive understanding of how different pre-service teachers respond to contingent moments across various classroom settings.
2. While the VSR interviews provided insights into teachers' reflections on their responses, no follow-up lesson observations were conducted to determine whether these reflections led to actual changes in teaching practice. This is particularly relevant for Ms. Baya, who acknowledged missed opportunities but was not observed again to assess whether she improved in responding to contingency moments.
3. The frequency and nature of contingency moments may have been influenced by contextual factors such as class size, learner participation, and lesson topics. For instance, Ms. Zukelwa's lesson had fewer contingencies, but this may have been due to the nature of the questions asked rather than her overall teaching ability. A broader study incorporating different teaching contexts would provide deeper insights into these dynamics.

5.6 Recommendations

1. Teacher education programs should integrate explicit training on how to recognize, respond to, and leverage contingency moments in mathematics classrooms. This should include practical strategies such as case studies, micro-teaching, and simulated classroom scenarios.

2. The Department of Education should consider revising ATP guidelines to allow for greater flexibility in pacing. This would enable teachers to respond meaningfully to learners' questions and unexpected learning moments without feeling pressured to rush through topics.

3. In-service teacher workshops should include training on adaptive teaching practices, particularly on responding to unplanned teaching moments. This would help teachers develop the ability to engage with learners' unexpected ideas and misconceptions effectively.

5.7 Suggestions for Further Research

1. Future research should conduct follow-up classroom observations after VSR interviews to examine whether pre-service teachers, especially those who recognize their limitations (e.g., Ms. Baya), improve in responding to contingency moments over time.
2. Further research should investigate the extent to which strong mathematical content knowledge correlates with effective responses to contingent moments. This could involve a comparative study with a larger sample of pre-service teachers from different training institutions.

5.8 Conclusion

This study contributes valuable insight into how content knowledge and reflection practices shape the ability of pre-service teachers to adapt in real-time during instruction. In doing so, the researcher observed lessons taught by preservice teachers around Johannesburg in primary schools. These teachers responded differently to contingency moments, some responses were coded inappropriate, while others were coded appropriate at minimum, middle, or maximum levels. Findings reveal that with adequate knowledge of mathematical content, teachers can handle the contingency moments in the classroom. This highlights the importance of assigning mathematics teaching to those who have specialized in the subject and encouraging teachers to be lifelong learners. Moving away from outdated traditional teaching methods will better prepare teachers to respond effectively to unexpected classroom situations and promote deeper learner engagement.

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APPENDIX A

VSR interview schedule

Ms Baya

I'd like to express my gratitude to the interviewee for agreeing to let me videotape her class and for making time for this discussion of the lesson during the interview. The meeting will not take more than 20 minutes. I will first show the interviewee certain episodes of the video where contingent moments are visible and start asking questions. You should be aware that the interview questions will be based on a preliminary analysis of the observed lessons.

Table 1: Summary of analysis of Baya's quality of responses to contingent moments

Lessons	**Levels**				**Total**
	Maximum	Middle	Minimum	Inappropriate	
Lesson 1(2 D Shapes)	1	1	1	1	5
Lesson 2 (Viewing objects)	1	0	0	2	3
Lesson 3 (Data Handling	0	0	0	1	1
Total	2	1	1	4	8

The interview questions below are generated from the different lessons of Miss Baya which were observed. Decide on whether to watch the whole lesson or selected episodes. After watching, then the interview will start.

Introductory question.

- Tell me what is the goal of your lesson? What do you aim to achieve at the end of the lesson?
- Do you think you have achieved this aim which you had hope the learners will take up after the lesson? Please give examples
- Do you think there were any disruptions in terms delivering your lesson in terms of what you had hope you'd deliver it. Anything which made you to deviate from what you had planned?

Discussion

Contingency 1

- Please tell me more about the reason behind the way you respond to learner X's input in the class, when she said '*2D shapes has both sides straight hides her face'*.
- *More prompt based on the participant's initial response.*

- Will you respond to the students' contributions in the same way or differently if the lesson were to be repeated? kindly elaborate

Contingency 2

- Please tell me more about the reason behind the way you respond to learner Y's input in the class, when one learner answered, '*a triangle and immediately after that another one said Nxantathu'. Then you said, that's it guys, you know them mos.*
- *More prompt based on the participant's initial response.*
- According to you were they pointing at the same shape? If yes, do you think they were aware?
- Will you respond to the students' contributions in the same way or differently if the lesson were to be repeated? kindly elaborate

Contingency 3

- Please tell me more about the reason behind the way you respond learner Z's input in the class, when she answered, *'phones, you punch in airtime.' Then you moved on with the lesson.*

  The question was what data handling.
- *More prompt based on the participant's initial response.*
- When learner Z provided the wrong answers, you didn't respond but rather moved on with the lesson, was there a reason for that? At that precise time, what were you contemplating?
- Will you respond to the students' contributions in the same way or differently if the lesson were to be repeated? kindly elaborate

Teacher insight during the lesson

- Is there anything else you'd like to say?

VSR interview schedule

Ms Zukelwa

I'd want to express my gratitude to the interviewee for agreeing to let me videotape her class and for making time for this discussion of the lesson during the interview. I will explain to the interviewee that the meeting will not take more than 20 minutes of her time. I will first show

the interviewee certain episodes of the video where contingent moments are visible and start asking questions. You should be aware that the interview questions will be based on a preliminary analysis of the observed lessons.

Lessons	**Levels**				**Total**
	Maximum	Middle	Minimum	Inappropriate	
Lesson 1 (Time)	0	1	0	0	1
Lesson 2 (Time)	0	0	0	1	1
Lesson 3 (Time)	0	0	0	0	0
Total	0	1	0	1	2

The interview questions below are generated from the different lessons of Miss Zukelwa which were observed. Decide on whether to watch the whole lesson or selected episodes. After watching, then the interview will start

Introductory question.

- Tell me what is the goal of your lesson? What do you aim to achieve at the end of the lesson?
- Do you think you have achieved this aim which you had hope the learners will take up after the lesson? Please give examples
- Do you think there were any disruptions in terms delivering your lesson in terms of what you had hope you'd deliver it. Anything which made you to deviate from what you had planned?

Discussion

Contingency 1

- I realised that the learners were referring to the instrument as an analogue clock, and as they were saying analogue clock, you kept on saying 'this is a clock' and then ask them, 'this is a'? until the learners changed and said, it's a clock teacher.
  Was there a reason for that, why did you keep on emphasizing that this is a clock?
- Do you think the method worked?

- *More prompt based on the participant's initial response.*
- Will you respond to the students' contributions in the same way or differently if the lesson were to be repeated? kindly elaborate

Contingency 2

Please provide your thoughts on how you handled learner Y's question in the class when she asked 'what is the difference between analogue clock and digital clock?

- Will you respond to the students' contributions in the same way or differently if the lesson were to be repeated? kindly elaborate
- *More prompt based on the participant's initial response.*

Teacher insight during the lesson

- Is there anything else you'd like to say?

VSR interview schedule

Mr Luphiwo

I'd want to express my gratitude to the interviewee for agreeing to let me videotape his class and for making time for this discussion of the lesson during the interview. I will explain to the interviewee that the meeting will not take more than 20 minutes of his time. I will first show the interviewee certain episodes of the video where contingent moments are visible and start asking questions. You should be aware that the interview questions will be based on a preliminary analysis of the observed lessons.

Table 3

Lessons	**Levels**				**Total**
	Maximum	Middle	Minimum	Inappropriate	
Lesson 1(Comparing length)	2	0	0	0	2
Lesson 2(2D shapes)	2	0	0	0	2
Lesson 3 (Irregular shapes)	1	0	0	0	1
Total	5	0	0	0	5

The interview questions below are generated from the different lessons of Mr Luphiwo which were observed. Decide on whether to watch the whole lesson or selected episodes. After watching, then the interview will start.

Introductory question.

- Tell me what is the goal of your lesson? What do you aim to achieve at the end of the lesson?
- Do you think you have achieved this aim which you had hope the learners will take up after the lesson? Please give examples
- Do you think there were any disruptions in terms delivering your lesson in terms of what you had hope you'd deliver it. Anything which made you to deviate from what you had planned?

Discussion

Contingency 1

- This is what you said at the beginning of your lesson, *"we are going to compare and order length. Before we start with our lesson, let us go back a little. What do you understand about length, what is length?*

  Would you like to tell me why you think it was important for you and the leaners to start there? Was there a reason for this because it's not written in the lesson plan.
- *More prompt based on the participant's initial response.*
- Do you think the learners responded well to your question? Please elaborate.
- Will you respond to the students' contributions in the same way or differently if the lesson were to be repeated? kindly elaborate

Contingency 2

- Please provide your thoughts on how your learners handled your question in class when you were asking "why are we multiplying".
- Would you have loved for them to react differently to that question? If yes, please kindly elaborate.
- I have also noticed that you asked a lot of questions during the lesson, even questions which they would deem as easy, why was it important for you to ask those questions?

- Will you respond to the students' contributions in the same way or differently if the lesson were to be repeated? kindly elaborate
- *More prompt based on the participant's initial response.*

Teacher insight during the lesson

- Is there anything else you'd like to say?

APPENDIX B

Pre-service teacher's Consent Form:

Kindly complete the consent form and return the reply slip below indicating your willingness to be interviewed for my research project called:

Pre-service teachers responses to and reflections on contingent moments in intermediate phase mathematics teaching

I, _____

Give/do not give (please delete as appropriate)

Permission to be observed in class

I agree to be observed in class. YES/NO

Permission to be videotaped

I agree to be videotaped during the lesson observation YES/NO

I know that the video-recordings will be used for this project only YES/NO

Permission to be interviewed

I agree to be interviews. YES/NO

Permission to be audiotaped

I agree to be audiotaped during the interview YES/NO

I know that the audio-recordings will be used for this project only YES/NO

[ ] I know that I don't have to answer all the questions and that I may withdraw from the study at any time without prejudice and/or penalty.

[ ] I am aware that the researcher will keep all information confidential in all academic writing.

[ ] I am aware that the audio and video-recordings will be destroyed within 3—5 years after completion of the project.

Teacher's Signature: _____ Date: _____

APPENDIX C

Information Sheet for Learners

Dear Learner,

My name is **Anelisa Mzimazi** and I am a part-time master's student in the **School of Education** at the **University of the Witwatersrand**.

I am doing research on **Pre-service Teachers' Responses to and Reflections on Contingent Moments in Intermediate Phase Mathematics Teaching**. This research will help us understand how teachers make quick decisions during lessons and the kind of support they might need to respond well to unexpected situations.

I will be **observing and video-recording** your teacher while they teach mathematics. This means that you might appear in the video. I need your permission to record while you are in the class.

Here are some important things to remember:

- This is **not a test** and has **nothing to do with your marks**.
- It is **not compulsory** for you to appear in the video.
- If you agree now but change your mind later, you can tell me, and I will position the camera so that you are not filmed.
- I will not use your real name in my research. I will use a made-up name so that no one can identify you.
- All the information about you will be kept **private**.
- The videos will be stored safely and **destroyed 5 years** after the research is completed.

If you have any questions, you can ask me at any time.

Thank you very much for your help!

Yours sincerely,
Anelisa Mzimazi

Researcher's name: Anelisa Mzimazi
Researcher's email: anelisamzimazi@gmail.com
Researcher's contact number: 078 4910 201

Supervisor's name: Dr Lawan Abdulhamid
Supervisor's email: Lawan.Abdulhamid@wits.ac.za
Supervisor's telephone number: 011 717 3468

Assent form: Learner

Learner
I am happy to be observed and appear in the mathematics lesson video YES/NO
I am happy for the extract from these videos to be viewed by the researchers for research purpose YES/NO
Learner name: _____ Learner signature: _____ Date: _____

APPENDIX D

Information sheet: Parent/Guardian

Dear Parent/Guardian

My name is **Anelisa Mzimazi**, and I am a part-time Master's student in the **School of Education** at the **University of the Witwatersrand**.

I am conducting research on **Pre-service Teachers' Responses to and Reflections on Contingent Moments in Intermediate Phase Mathematics Teaching**. This study will provide insight into how teachers make decisions "in the moment" during lessons when unexpected situations occur, and the kind of support they may need to respond effectively.

My research involves **observing and video-recording mathematics lessons** at your child's school, with the focus being on the mathematics teacher. While the study is not specifically about learners, some learners may appear in the recordings because they will be interacting with the teacher during lessons.

Please note:

- Your child will not be advantaged or disadvantaged in any way by participating.
- Participation is voluntary, and your child may withdraw at any time without any penalty.
- There are no foreseeable risks in participating, and no payment will be made for participation.
- Your child's name and identity will remain **confidential** in all academic writing and publications related to the study.
- All research data, including video recordings, will be stored securely and destroyed within **3–5 years** after the completion of the project.

If you require any further information, please feel free to contact me.

Thank you very much for your assistance.

Yours sincerely,
Anelisa Mzimazi

Researcher's name: Anelisa Mzimazi
Researcher's email: anelisamzimazi@gmail.com
Researcher's contact number: 078 4910 201

Supervisor's name: Dr Lawan Abdulhamid
Supervisor's email: Lawan.Abdulhamid@wits.ac.za
Supervisor's telephone number: 011 717 3468

Parent/Guardian consent form

Parent/Guardian
I consent / do not consent* for my child to be observed and appear in the mathematics lesson video
I consent / do not consent* for the extract from these videos to be viewed by the researcher and for research purpose
School name:_____ Parent name:_____ Child name:_____ Parent Signature:_____ Date:_____

* Please delete as appropriate

APPENDIX E

Information sheet: Principal

Dear Principal,

My name is **Anelisa Mzimazi**, and I am a part-time Master's student in the **School of Education** at the **University of the Witwatersrand**.

I am conducting research on **Pre-service Teachers' Responses to and Reflections on Contingent Moments in Intermediate Phase Mathematics Teaching**. The study aims to give insight into how teachers make decisions "in the moment" when unexpected situations occur during lessons, as well as the kind of support they may need to respond effectively.

My research will involve:

- **Videorecording** three sequential mathematics lessons to observe how teachers respond to moments of contingency during teaching.
- **Interviewing** participating teachers and **audio-recording** these conversations to gain further insight into their reflections and decision-making during the recorded lessons.

Please note:

- The names and identities of the school and teachers will remain **confidential** in all academic writing and presentations.
- The privacy of all participants will be maintained in any published or written material arising from the study.
- All research data will be securely stored and destroyed within **3–5 years** after the study is completed.
- Participation is entirely **voluntary** and teachers (and learners present in lessons) may withdraw at any stage without prejudice or penalty.
- There are no financial rewards for participation.

If you require further information, please feel free to contact me. I look forward to your response at your earliest convenience.

Thank you very much for your assistance.

Yours sincerely,

Anelisa Mzimazi

Researcher's name: Anelisa Mzimazi

Researcher's email: anelisamzimazi@gmail.com

Researcher's contact number: 078 4910 201

Supervisor's name: Dr Lawan Abdulhamid

Supervisor's email: Lawan.Abdulhamid@wits.ac.za

Supervisor's telephone number: 011 717 3468