Teaching strategies used by Junior Primary teachers to enhance learners' mathematical reasoning ability in solving mathematical problems

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Abstract
This paper investigated the teaching strategies used by Junior Primary teachers to help learners reason mathematically at two selected schools in Oshana region. The paper was triggered by the need for intervention to seek ways of mitigating this problem of poor reasoning skills among the Junior Primary learners. Consequently, the study sought to answer the questions: What strategies do the Junior Primary teachers use to help learners reason mathematically when doing problem solving and computation? This study used a qualitative approach, using convenient sampling technique to gather data from a sample of six (6) Junior Primary school teachers from the two selected schools for the purpose of this study. Classroom observations revealed that strategies to enhance reasoning such as problem solving, which is one of the strategies to measure learners' mathematical reasoning, was lacking in lessons. The activities given to learners had little to do with reasoning. In addition, teachers were mostly inclined to use closed-ended questions and short answer questions which promoted less reasoning compared to open-ended questions. This study recommended that Advisory Services together with UNAM numeracy lecturers should arrange training sessions for Junior Primary teachers on different calculation strategies, the use of appropriate teaching materials in mathematics lessons to demonstrate and illustrate various mathematics concepts to increase the learners' understanding and reasoning skills and problem solving. Junior Primary teachers should apply Bloom's taxonomy in planning learning activities for their learners, and to determine the type of questions asked in the lessons.

Keywords: *teaching strategies, Junior Primary teachers, mathematical reasoning, problem solving, mathematical ideas*

Background of the study

Several Mathematicians and mathematics educators (Long & DeTemple, 2000; Su et al., 2016; Zaini & Retnawati, 2019) hold the viewpoint that problem solving cannot be detached from Mathematics as a subject. Therefore, the teaching of mathematical rules for computation and the use of memorization in mathematical lessons is ineffective (Long & DeTemple, 2000). Learners need to learn how to think in imaginative ways about numbers and qualitative situations. Developing the process standards of mathematics is therefore very important from pre-kindergarten to Grade 12. These process standards are problem solving, reasoning and proof, communication, connection and representation (Long & DeTemple, 2000). One of the aims of teaching mathematics in Grades 1 – 3 in the Namibian context is to develop functional numeracy and mathematical thinking (Ministry of Education, Arts and Culture, 2015). The Junior Primary mathematics syllabus for Namibian schools further states the following competencies for learners to achieve under Problem Solving: apply efficient methods and strategies to solve problems, explain the method used and to listen to other learners' explanations (Ministry of Education, Arts and Culture, 2015). Thus, mathematical reasoning in the Namibia curriculum tends to focus on problem solving and the application of concepts to real life situations. Against this background, the researchers wanted to carry out a study to find out how Junior Primary teachers in the two selected schools in the Oshana region teach the learners to reason mathematically.

The researchers, being involved in Junior Primary Teacher Education, noticed the poor mathematical reasoning which is coupled with poor problem solving and mental calculation skills among Junior Primary learners in the four regions (Oshana, Oshikoto, Ohangwena, and Omusati). This was picked up through interacting with the support teachers, student teachers and learners during School Based Studies (SBS). Senior Primary mathematics teachers have also alleged a poor foundation of Mathematical reasoning and poor problem-

solving skills among the learners coming from the Junior Primary School Phase. Ayal et al. (2016) argue that in most schools, the learning of mathematics is still dominated by the activities of the exercises for the achievement of basic mathematical skills alone. In addition, it is argued that Junior Primary teachers are not building a solid foundation of Mathematics in this phase (Nambira et al., 2009). Learners at this phase do not have good number sense and problem-solving skills. It is therefore plausible to argue that if no intervention is carried out to the improve the reasoning skills which are ultimately anticipated to improve the calculation skills of the learners, the Junior Primary school learners will continue to underperform even in the Senior Primary school phase. Mathematical reasoning is an essential skill that needs to be applied by teachers in mathematics activities to guarantee that students' mathematical thinking, understanding of concepts and performance are enhanced (Mahmud & Mohd Drus, 2023).

There is hence a need for intervention to seek ways of mitigating this problem of poor reasoning skills among the Junior Primary learners. Otherwise, this deficiency of reasoning skills will compromise the overall performance of the Junior Primary learners in mathematics and in their subsequent grades. It is therefore against this background that this study was carried out to investigate the strategies that were used by Junior Primary teachers to enhance reasoning in their mathematics classroom in order for the researchers to help pre-service teachers to teach in a manner that provoke mathematical reasoning among their learners. The study thus sought answers to the following questions:

1. What strategies do the Junior Primary teachers at two selected school in Oshana region use to help learners reason mathematically when doing problem solving and computation?
2. How effective are the strategies used by the Junior Primary teachers from the two selected school in Oshana region to enhance learners' mathematical reasoning ability?

Literature review

The National Council of Teachers of Mathematics (NCTM) (2000) provides seven mathematical processes important in successful mathematics teaching and learning. These mathematical processes reveal the ways of acquiring and using mathematical content (Coronata & Alsina, 2014). According to Coronata and Alsina (2014), the seven processes are *communication* - which is a tool that encourages learners' interaction to clarify their mathematical ideas. *Connections* - This process is an integrated field of study necessary for learners to recognize and make connections between mathematical ideas and to consider mathematical connections with other subjects or topics and the everyday life to understand mathematics usefulness.

Reasoning - is about learners becoming more aware of the meaning of mathematics and how it offers powerful alternatives to understand a variety of phenomena. Reasoning is developed when learners investigate mathematical conjectures, develop and evaluate arguments and demonstrations. *Mental mathematics and estimation* - determining answers without paper and pencil, estimation is used for determining in approximate values or quantities, by referring to benchmarks or referents. *Problem solving* - which involves building new mathematical knowledge to reflect, use and adapt strategies that promote problem solving situations. *Visualization* - ways of representing mathematical ideas, which could be through pictures, concrete materials, tables, graphs, numbers, letters, and more (Coronata & Alsina, 2014). *Technology* - enables students to explore and create patterns, examine relationships, test conjectures and solve problems. In the same vein, Kilpatrick et al. (2001) identified mathematics proficiency as necessary for anyone to learn mathematics successfully. They indicated that mathematics proficiency has five strands: *Conceptual understanding:* which is comprehension of mathematical concepts, operations, and relations.

Procedural fluency: this is about skill in carrying out mathematical procedures flexibly, accurately, efficiently, and appropriately. *Strategic competence:* the ability to formulate, represent, and solve mathematical problems. *Adaptive reasoning:* the capacity for logical thought, reflection, explanation, and justification. Lastly, *Productive disposition*: the habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy. Although Kilpatrick et al. (2001) have stressed that the five strands are intertwined and interdependent, this study mainly focused on

teaching strategies the Junior Primary teachers in the two selected schools used to develop mathematical reasoning skills in their learners. Reasoning is one of the five strands of mathematics proficiency. Both reasoning as a mathematical process and adaptive reasoning as a strand described above bear the same meaning. Herawati and Amelia (2020) defined reasoning as the cognitive process through which individuals draw logical conclusions from evidence, facts, or assumptions. It entails analysing and interpreting information to develop justified inferences and judgments. Various studies have emphasized the importance of reasoning in mathematics, emphasising reasoning as one of the key components which is central not only to the teaching and learning of mathematics but also in community participation (Segerby & Chronaki, 2018).

According to Mata-Peireira and da Ponte (2017) mathematical reasoning provides learners with conditions to engage in proving and allowing them to go beyond the routine use of procedures towards learning concepts and properties. According to Ayal et al. (2016) mathematics and reasoning are interconnected and thus inseparable. They indicated that mathematics content is mostly learnt and understood well through reasoning and thus, mathematical reasoning is an important part in mathematics learning. Through mathematical reasoning learners are able to complete challenging mathematical problems that could not have been solved in the absence of reasoning (Ayal, et al., 2016). The importance of reasoning in mathematics is further supported by Hasanah et al. (2019), that for learners to become successful in mathematics, they need to master the reasoning ability. This is because according to Mahmud and Mohd Drus (2023), reasoning assists learners in solving various mathematical problems, especially the non-routine mathematical problems, by employing various logical and creative mathematical solution methods.

Reasoning enables learners to view mathematics as a logical study and feel confident when doing mathematics and most especially when solving mathematical problems. Having a good reasoning ability also enables learners to grasp mathematical concepts more easily because of the structure and the strong connection that exist within the concepts of mathematics itself (Basra & Fauzi, 2016). On the other hand, reasoning ability is found to be very useful for learners to solve problems in daily life (Basra & Fauzi, 2017). The use of reasoning in solving problems means learners have to think logically about the situation and apply that logic in relation to the previous experience or new information. According to Herawati and Amelia (2020), mathematical reasoning form part of the problem-solving process that involves thinking and reasoning skills of students in seeking complementary solutions to problems. Mathematical reasoning further ensures the production of skills required for future higher-level mathematics (Su et al., 2016) when learners have to test and apply theories and axioms. Herbert and Bragg (2021) indicated that learners in elementary schools apply reasoning when making sense of mathematics and solving an unfamiliar problem.

At the Junior Primary level, learners employ reasoning when exploring and making connections. Whereas at the upper grades, learners are expected to apply reasoning and logic during exploration, analysing, and applying mathematical ideas, creating patterns and relationships, and testing assumptions. When learners are presented with a problem to solve, they get the opportunity to employ reasoning during the process of understanding the problem, while solving and when drawing conclusion (Hasanah et al., 2019). Zaini and Retnawati (2019) outlined the importance of mathematical reasoning abilities during the process of mathematical understanding, discovering ideas, estimating solutions, applying mathematical expressions in relevant mathematical contexts, and in considering mathematics as meaningful. When learning mathematics, the reasoning ability plays an important role to help learners to solve mathematic problems.

Thus, learners should be guided so that they are able to have good Mathematical Reasoning Abilities (Basra & Fauzi, 2017). Improving critical thinking abilities requires more practice and to be actively engaged in the skill of thinking critically (Su et al., 2016). For that, there is a need for a teaching and learning strategy that is considered appropriate and specific so that it can improve learners' mathematical reasoning abilities. Researchers have looked at teaching strategies related to mathematics reasoning abilities in learners (Ayal eta al., 2016). One of the teaching strategies that could make the learning environment attractive, motivate learners and

ensure learners experience fun when learning the mathematics materials is Mind Mapping (mind maps) (Ayal et al., 2016). A mind map is an organizational tool that supports thinking; it can be described as a graphic technique with the right combination of words, images, lines, colours, compatibility with the structure, activity and function of the brain to unlock the potential for the brain to process information. Gargouri and Naatus (2017) argue that a mind map can be used to provide clarity of reasoning based on supporting evidence to achieve meaningful conclusions that improve decision-making skills. Napitupulu et al. (2016) noticed that by using problems-based learning in their study, learners' mathematical reasoning increased compared to regular learning. Another teaching strategy identified by Mahmud and Mohd Drus (2023) is the teacher's oral questioning. This teaching strategy can stimulate learners' thinking and allow the teacher to understand the level of learners' achievement.

In addition, it gives opportunity to learners to explain their understanding of concepts (Mahmud & Mohd Drus, 2023). Furthermore, Muhamed and Mohd Drus (2023) identified six types of oral questions as being used by mathematics teachers to help learners improve their mathematical reasoning skills and thinking. These types of questions are: provocative mathematical questions, puzzle-shaped questions, breaking down hard problems into easier parts, contextual questions, questions to explain the mistakes, and questions asking for clarification. Mukuka et al. (2023) outlined five classroom activities to improve learners' mathematical reasoning; *Communication*- a way through which teachers and learners share ideas and become clear, convincing, and decisive in their mathematical expression. The second is *multiple representations* which may include words, symbols, diagrams, formulas, grids and tables, manipulatives, graphs, pictures, and many more. They stressed that learners should be supported with various mathematical representations and be encouraged to construct mathematical meaning from the representations.

The third activity is *modelling with mathematics*, this means allowing learners to put real-world experiences into mathematical terms or relating mathematical content to various practical situations to enhance learners' mathematical reasoning skills. The fourth activity is *mathematics task*s - teachers are encouraged to pose questions that give learners opportunities for thinking and sense-making processes rather than assigning exercises that just require learners to follow memorized procedures or imitate worked examples. The fifth is *teacher's talk* - this means a teacher's discussion or inquiry should be intended to support learners in reflecting on and expanding upon their prior knowledge as they produce new knowledge. *Classroom discussion*, according to Mata-Pereira and da Ponte (2017) yields opportunities for learners to share, discuss and evaluate their ideas and thus develop mathematical reasoning. However, to promote learners' mathematical reasoning, teachers need to provide challenging learning environments rather than just lessons where they solve exercises using well-known procedures (Mata-Peireira & da Ponte, 2017). According to Ayal et al. (2016), teachers must diversify their teaching strategies, techniques, and levels of oral questioning (higher-order or lower-order) to suit the learners' conditions. Furthermore, teachers should have the ability to practice effective questioning skills and strategies to instil thinking skills.

Methodology

Research design

This study used a qualitative approach. This was done for generating the data that facilitated a deeper understanding of teacher practices in Junior Primary mathematics classrooms concerning stimulating learners to reason mathematically. Since this study focused on the collection, synthetizing and analysing of non-numerical data, that is, the identification of teaching strategies that help learners reason mathematically, a qualitative research approach was deemed the necessary approach in the collection, presentation, and analysis of data.

Population and sampling

Gay et al. (2009) defined population as the large group from which the sample is selected. The population of this study comprised all Junior Primary teachers from the two selected schools in Oshana region. This was because the schools were at the convenience of the researchers as per recommendations of Cresswell (2013). Additionally, the two schools were identified as the schools of concern, require assistance in Oshana region.

Convenient Sampling technique was utilized to gather data from a sample of six (6) Junior Primary teachers from the selected schools for the purpose of this study. Cresswell (2013) defines convenient sampling as a sampling procedure where the researcher selects participants based on their availability. In this study, the schools were conveniently selected because they were within the working environment of the researchers. However, it was also deemed necessary that the number of participants were such that it possessed critical mass; therefore, all six participants were selected to take part in the study.

Research instruments

A questionnaire with both open ended and closed ended questions was utilized to draw data from the participants. The purpose of the questionnaire was to seek answers to the question of what strategies Junior Primary teachers used to assist their learners to reason mathematically. In addition, for triangulation purposes, the researchers also utilized an observation sheet to gather data which ultimately yielded the response to the question of what teaching strategies were used by Junior Primary teachers to help learners reason mathematically.

Ethical consideration

Approval to carry out the study was sought firstly from the directorate of education of the Oshana region, then from the school principals and finally from the teachers. Teachers were also informed of the purpose of the study and were asked to sign a consent form. The participants were assured that their personal information will remain confidential and that the findings of the study were solely to help lecturers in preparing the pre-service teachers to effectively incorporate reasoning in the teaching of Junior Primary mathematics.

Data analysis

Data analysis is the process of organizing, interpreting, and making meaning from raw data collected during a study (Creswell & Creswell, 2017). In this study, data were collected through teacher interviews and non-participant classroom observations. The study embraced the qualitative approach for data collection. The data were thus analysed using *segmenting*, where the data collected during the interviews and observations were divided into units, *coding*, a process in which the data were further marked with category names and then finally the development of a *master list*. The master list was used to provide headings in which the data were presented and analysed (Johnson & Christensen, 2012).

Presentation and discussions of results

This study was conducted at two primary schools located in the Oshana region. The study aimed at investigating strategies used by Junior Primary teachers to develop reasoning skills in learners. The schools were selected because of their close proximity to the researchers' place of work. This enabled the researchers to do lesson observations and interviews with the teachers in between lectures and other commitments. Schools were identified as School A and School B. Six Junior Primary teachers were included in the study, three from each school. Teachers were identified as Teacher 1, 2, 3, 4, 5 & 6 (T1, T2, T3, T4, T5 and T6). The teachers taught the following grades: School A: Grades 1, 2 & 3. School B: Pre-primary, Grades 1 and 3.

Biographical information

All participants were qualified teachers with degrees and diplomas. Their teaching experience ranged from 2 months to 9 years.

Table 1: Participants' years of teaching experience and qualifications

Participants	Years of teaching experience	Highest qualification
T1	2 months	Bachelor of Education Degree (Honors)
T2	3 years	Diploma in Junior Primary Education
T3	5 years	Diploma in Junior Primary Education
T4	9 years	Bachelor of Education Degree
T5	4 years	Diploma in Junior Primary Education
T6	7 years	Bachelor of Education Degree (Honors)

Data collected during interviews and lesson observations

Teachers were observed in the following mathematics topics:

T1: Counting
T2: Place value
T3: Number patterns
T4: Spatial relationships
T5: Computation
T6: Money

Teachers' understanding of mathematical reasoning and the benefits

Participants demonstrated a general understanding of mathematical reasoning as a process involving logical thinking and problem solving. For example, T2 defined mathematical reasoning as: *"A part of mathematics where we determine the true values of given statements."* For T3, mathematical reasoning is: *"A skill that enables learners to evaluate their answers to a given sum of story problem"*. Similarly, T5 defined it as: *"a process of applying logical thinking to a situation to obtain the correct story problem strategy, for a given question using the method of describing a problem and developing a solution".* T6 stated that: *"reasoning in mathematics is the process of applying logical thinking to a situation to drive the correct problem-solving strategy for a given question".* Participants were also asked how important it was for learners in using reasoning were doing in mathematical activities. Regarding the benefits of mathematical reasoning, T4 indicated that: *"Some of the benefits are that reasoning helps learners develop logical thinking and confidence when solving problems".* Similarly, T3 stated that: *"Mathematical reasoning helps learners to draw logical conclusions, to understand and solve mathematical problems".* On the other hand, T4 believed that: *"Mathematics reasoning promotes the development of learners' memories, logical thinking and increases learners' abilities to solve intellectual problems and thus promoting self-confidence".* In addition, T1 indicated that: *"Mathematical reasoning improves problem solving abilities and helps learners to evolve into logical thinkers."*

These responses suggest that participants associated mathematical reasoning with logical thinking, problem solving, and learners' confidence. According to Hasanah et al. (2019) when learners are presented with a mathematical problem to solve, they tend to employ reasoning during the process of understanding the problem, solving the problem, and drawing conclusion. Mahmud and Mohd Drus (2023) indicated that reasoning assists learners in solving various mathematical problems by employing various logical and creative mathematical solution methods. This, therefore, might help learners to grasp mathematical concepts more easily (Basra & Fauzi, 2017). According to Mukuka et al. (2023), learners' enriched mathematical reasoning has the potential to increase sense-making, conceptual understanding, and application of mathematical knowledge to real life situations.

Teaching and learning strategies used in the mathematics lessons and their effectiveness in promoting reasoning

Participants were also probed on the teaching strategies they used in their mathematics lessons to promote reasoning. Three predominant strategies that emerged from the participants' responses were as follows: the use of manipulatives strategy, questioning strategy and step-by-step strategy. A number of participants, specifically T2, T3, T5 and T6 stated that they encouraged the use of physical materials to enhance reasoning. T3 specifically indicated that: *"I encourage learners to carry out calculation by using the ten frames, counting on fingers or concrete objects,* identify *the problem and the operations that learners should use, using multiple steps. The use of manipulatives helped learners to think critically and solve story problems and sums in a limited time".* Likewise, T2 expressed that: *"Learners are first allowed to identify a problem and then use direct modelling by using physical materials to promote reasoning".*

According to the participants, manipulatives help learners think through mathematical processes rather than merely memorizing procedures. Participants also identified questioning as an important strategy for promoting reasoning. T1 explained that: *"I start the lesson with a question and have learners explain the steps they used to get the answer".* T1 further stated that*: I engage learners in various activities such as sorting and organizing, working with patterns, drawing pictures to find answers and use mapping. These strategies were very effective, as they sought to stimulate learners' critical thinking.* T2 indicated that: *"I asked open-ended questions as they solve the problem which encouraged creative thinking and evaluating of information".* It was also

mentioned by T2 that: *"Questioning also helps learners broaden their knowledge of thinking and solve the problem within a limited time*". Nevertheless, T4 used multiple strategies, as asserted that: *"I look for patterns, find a rule, use visuals and images, guess and check, and draw a picture or a diagram".* During classroom observations, the researchers discovered that teachers used less to no reasoning strategies in their mathematics lessons to enhance reasoning skills. It was observed that although there were interactions between the teacher and learners, the teachers mostly used closed ended questions and short answer questions. For instance, in T4 class, the question-and-answer method was used, and learners had to identify positions discussed in pictures which had little to do with promoting reasoning. In T5 class, the learners used a number line drawn on the board to demonstrate addition. According to T5 it helped the learners to develop conceptual understanding and promote mathematical understanding. In T6 class the learners were asked questions which they answered verbally and most of the time learners answered questions in a chorus. However, according to T6 this strategy helped the learners to understand what he/she was doing. The researchers noticed that although teachers claimed to use reasoning strategies in their mathematics lessons to promote mathematical reasoning, the lesson observations revealed that most teachers included in the study did not use any reasoning strategies at all. According to Langa (2021), leaners' mathematics understanding and reasoning skills increased when using manipulatives. Langa (2021) further added that when learners used manipulatives to solving mathematics questions their understanding improved.

Mukuka et al. (2023) stated that the way a teacher asks questions during a lesson has a big impact on how the student will understand the mathematics concepts. Skilful probing can help teachers see how learners built their mathematical ideas. The oral questioning strategy is further supported by Mahmud and Mohd Drus (2023) because it has the potential of stimulating learners' thinking and allowed teachers to understand the level of learners' achievement. However, they caution teachers to practice effective questioning skills and strategies to enhance reasoning skills. In addition, Mukuka et al. (2023) also stressed that teachers' inquiry should aim at supporting learners to reflect on and to expand their prior knowledge as they produce new knowledge. Mukuka et al. (2023) indicated that the use of multiple representations has been recognized as an important aspect for promoting higher-ordered thinking. Adding that apart from manipulatives, teachers can use words, symbols, diagrams, formulas, pictures, or grids to promote reasoning.

According to Napitupulu et al. (2016), using problem-based learning increases learners' mathematical reasoning compared to regular learning. This is also supported by Mukuka et al. (2023) who outlined that mathematics teaching should be relevant to the real-world experience of learners. Mukuka et al. (2023) furthermore suggested that allowing learners to connect mathematical concepts to real-life experiences and familiar contexts enhances their ability to reason mathematically and think critically. Although most teachers in the study reported that they actively promoted learners' mathematical reasoning, Mukuka et al. (2023) observed that classroom practices did not consistently reflect these claims. Teachers frequently missed opportunities during instruction to support and enhance learners' mathematical reasoning.

Problem solving activities given during the lessons observed

According to Herawati and Amelia (2020) one way to measure students' mathematical reasoning skills is through problem solving. Mathematical reasoning is part of the problem-solving process that comprises thinking and reasoning skills of learners in seeking alternative solutions to problems (Herawati & Amelia, 2020). Thus, the researchers thought it was worth looking at the kind of problem-solving activities teachers gave to their learners during their mathematics lessons. In addition, Mata-Pereira and da Ponte (2017) emphasised that though questions, in the form of problem solving, can allow for in-depth discussion, encourage exploration, promote reasoning and increase student involvement in the teaching process. It was observed that in T1, T2 and T4 lessons there were no problem-solving activities observed. Activities given to the learners had little to do with problem solving. In T3 lesson, the learners had to complete a sequence of missing numbers while in T5 lesson; the learners demonstrated a given number sentence on the number line on the chalkboard. In T6 lesson, the learners were

given an activity where they had to change coins to dollars; thus, problem solving was not really done in the lesson. An indication that most of the activities observed contained low level questions. Mukuka et al. (2023) argued that teachers ought to pose tasks and activities that are bound to elicit higher order thinking among learners because their reasoning is formed by the kind of tasks they encounter in the classroom.

Calculation strategies demonstrated during the lessons

Giving appropriate tasks to learners is regarded as one of the important aspects of stimulating learners' mathematical reasoning (Mata-Pereira and da Ponte, 2017). If a learner can use different strategies to calculate, it shows what they know, understand about numbers and mathematical concepts and how they reason. The following strategies were observed in the participants' lessons: T1 used concrete strategies: the learners used a number chart and the abacus to calculate simple addition sums e.g. 3+5 = 8. T2 used the decomposition method and a place value chart to help learners solve mathematical problems. In T3's lesson, no specific calculation strategies were observed or applied. T4 taught a lesson on spatial relationships to pre-primary learners. No calculations were observed during the lesson. Learners were observed demonstrating addition on the number line in T5 lesson. However, T6 did not focus on calculations in the observed lesson; the lesson focus was to identify various coins. Mukuka et al. (2023) emphasized the importance of designing activities that encourage learners to think critically and make sense of mathematical concepts, instead of relying on tasks that require the reproduction of memorised procedures or worked examples, as these approaches do not adequately support reasoning.

Assistance teachers need to improve learners' reasoning skills

Participants highlighted several areas in which teachers require support to effectively promote mathematical reasoning among learners. T1 indicated that: *"Teachers require effective teaching and learning materials to use in lessons and guidance on how to formulate effective questions"*, to support learners' mathematical reasoning. This view aligns with Ayal et al. (2016), who argue that to promote reasoning, teachers must use questioning strategies and levels of oral questioning (higher-order and lower-order) to meet learners' diverse needs and promote reasoning. Furthermore, the authors emphasised the importance developing effective questioning skills among teachers. T2 indicated that teachers need to *"Teachers need to implement mathematical reasoning strategies to cater for the learners with difficulties in math"*. T3 highlighted the need for teachers to be provided with adequate resources, when said that: *"Teachers need to be provided with materials so they could set up manipulative corners in their classrooms to create opportunities for hands-on learning and exploration".* T5 further reported that: *"Teachers need to set realistic goals and use rewards, as well as use hands–on learning methods"*. Hands-on learning experiences provide opportunities for learners to construct knowledge through exploration and interaction with mathematical ideas. T6 indicated that parent involvement was needed: *"Parents must give learners simple number-related activities at home including counting numbers to reinforce mathematical learning outside the classroom".* The participants' views suggest that the use of appropriate reasoning-based instructional strategies can enhance learners' conceptual understanding and problem-solving abilities, particularly for those who struggle with mathematical concepts.

Conclusion

This research intended to find teaching strategies used by Junior Primary teachers to help learners reason mathematically. Mathematical reasoning is a crucial skill that teachers at all levels need to employ in their teaching of mathematics to enhance learners' mathematical thinking and performance. Hence, knowing what strategies teachers use might help the researchers as lecturers to determine possible ways of helping pre-service teachers to teach learners in a manner that encouraged mathematical reasoning. Although teachers in this study understood reasoning and its impact and benefits on the learning of mathematics, it was evident from the findings that teachers used little or no strategies to enhance reasoning in their mathematics lessons. Most classroom observations revealed that strategies to enhance reasoning such as problem solving, which is one of the strategies to measure learners' mathematical reasoning,

were lacking in most lessons. Most of the activities given to learners had little to do with promoting reasoning. In addition, teachers were mostly inclined to use closed-ended questions and short answer questions which promoted less reasoning compared to open-ended questions. Appropriate questioning skills and the level of questions were another effective way to encourage reasoning, in-depth discussion and increase learners' involvement in their learning.

Recommendations

This study recommends that Advisory Services together with UNAM Numeracy lecturers should arrange a training session for Junior Primary teachers on different calculation strategies that teachers could implement in their mathematics lessons to help learners reason mathematically and demonstrate their understanding of the math concepts taught. In addition, Junior Primary teachers should use appropriate teaching materials in mathematics lessons to demonstrate and illustrate various mathematics concepts to increase the learners' understanding and reasoning skills. Junior Primary school teachers should apply Bloom's taxonomy in preparing questions to be asked during mathematics lessons and planning learning activities for their learners. This will enhance learners thinking capacity and thus encourage reasoning.

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