Analyzing Strategies and Methodologies of Teaching Mathematics in Japan and Namibia

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日本とナミビアにおける数学教育の戦略と方法論の分析

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ABSTRACT

This study compared elementary mathematics teaching strategies and methodologies in Japan and Namibia. Based on observation data, video recordings, and test analyses, it was found that each country had its modus operandi for teaching mathematics. While both countries used demonstration and brainstorming, different teaching approaches were also employed. Japan's elementary mathematics teaching employed a structured problem-solving approach based on lesson study, a learner-centered approach based on Vygotsky's theory of social constructivism. In Namibia, however, demonstrations were the most used method, guided by Bandura's theory of social/observational learning. Challenges were also observed as the teachers shifted from teacher-oriented to learner-oriented instruction. Japan's mathematics teaching strategies and methodologies were concluded to be more effective than those in Namibia, as learners showed a greater understanding, and the teachers appeared to have greater subject knowledge expertise and pedagogical content knowledge.

1．Introduction

1．1．Research background

The increasing demand for technical and scientific expertise in Namibia compelled the government to put greater stress on the teaching of math and science at school. Namibia's Vision 2030 and the associated National Development Plans had the primary goal of moving Namibia from a literate society to a knowledge-based society, which was defined by *Namibia's National Institute for Educational Development* (NIED) as follows; "A knowledge based society is one where knowledge is created, transformed and used for innovation to improve the quality of life" (NIED, 2016). The importance of mathematics in the technology age cannot be over emphasized as it

is not only an essential tool for everyday life, but is vital for the development of science, technology, and business. The Southern and Eastern Africa Consortium for Monitoring Educational Quality (SEACMEQ) and an EU delegation case study reported that while there had been increased investment in Namibia's primary education, the numeracy and literacy test outcomes remained a problem (Shigwedha, Nakashole, Auala, Amakutuwa, & Ailonga, 2015). In contrast, Japan was ranked near the top of the world by the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS). Therefore, given these disparities, there are mathematics teaching and learning lessons that Namibia could learn from Japan.

1．2．Problem statement

The SACMEQ IV results showed that Namibia was the third most improved country in Africa for mathematics and reading achievements (Shigwedha et al., 2015). However, there was only a three point improvement in teaching quality, which if not addressed could negatively affect the learners' futures, the Vision 2030 objectives of the Ministry of Education, and the Fifth National Development Plans (NDP5), which called for the primary curriculum reforms to focus on building strong numeracy and literacy foundations and promoting critical thinking and information literacy (NDP5, 2017). Over the years the author taught in Namibia, it was observed that the students has continuously poor mathematics performances, which prompted this mathematics teaching and learning comparative research between the strategies and methodologies used in Japan's mathematics elementary education and those used in Namibia.

1．3．Research objectives

The purpose of international comparative research is to identify the methodologies, implicit value systems, and best practices, with the aim of ensuring mutual benefit (Clarke, 2003). Therefore, this study sought to identify, describe and compare the teaching methodologies, strategies, and problem solving skills in elementary school mathematics lessons in Namibia and Japan with the primary purpose of developing and extending the international relationship and providing guidance on effective teaching methods and strategies to improve mathematics teaching and learning quality in Namibia. Due to Japan's high global mathematics literacy, this study focused on elementary mathematics lesson plans, teaching methods and strategies, and class interactions.

1．4．Research questions

Therefore, the following questions guided the study.

1. What are the elementary level mathematics teaching strategies and methodologies used in Japan?
2. What are the elementary level mathematics teaching strategies and methodologies used in Namibia?
3. What are the most effective elementary level mathematics teaching methods and strategies ?

1．5．Significance of the study

This study contributes to mathematics teaching in junior primary schools, with the results of this study highlighting best practice. Therefore, it is expected that the findings can

benefit junior primary school teachers, education officers, and other stakeholders, especially in Namibia, where effective solutions and exposure to best practice in mathematics teaching and learning could assist in meeting the country's 2030 development goals.

2. Literature review

2. 1. Introduction

This section discusses the theoretical framework used in this study to understand elementary level mathematics teaching methods, strategies, and the development of problem solving skills, and then explores research on (a) specific mathematics teaching methods and strategies, and (b) the effectiveness of these methods and strategies.

2. 2. Theoretical framework

This study was guided by constructivist learning theories to understand the teaching methods and strategies used in teaching mathematics, Constructivism is a knowledge theory that has roots in philosophy and psychology (Thadei, 2013). The founders of this theory were (Bruner, 1980; Dewey, 1986; Vygotsky, 1978), who believed that (1) knowledge was not passively received but actively built, and (2) cognitive functions were experientially adaptive (Thadei, 2013). The constructivist approach views instructors as facilitators who guide learners to gain their own understanding of the content, that is, the teacher encourages the development of critical thinking and inquiry by asking the students thoughtful, open-ended questions and allowing them time to question each other so they can construct their own meaning of the learning (Hawkins, 1994).

Specific theories assist teachers in developing appropriate methods and strategies that allow their students to acquire new knowledge by interacting with their environment, such as groupwork, pair work, and interactive teaching. Bandura, who used the term social learning or observational learning to describe this learning theory, believed that as learning occurred through imitation and modelling, the teacher had a significant influence on how the learners learnt (Omari, 2006) cited in Thadei (2013). However, Vygotsky believed that peer interaction was an essential part of the learning process and that teachers needed to employ teaching methods and strategies that enabled social interaction (Kleopas, 2020).

Students can gain knowledge and understanding by observing their teachers and peers, which they are likely to practice on the own. By successfully completing challenging tasks, learners gain the confidence and motivation to tackle more complex challenges, which Vygotsky called the zone of proximal development (ZPD) (Vygotsky, 1978). In practical terms, ZPD refers to the need for teachers to encourage student autonomy and initiative using both raw data and primary sources and manipulative, interactive, and physical materials (Thadei, 2013) that put the students in situations that challenge their previous ideas, encourage discussion, and make the learning meaningful.

Constructivist theory has had a significant influence on the teaching and learning of mathematics as a subject related to everyday life. In Japan, for example, mathematics teaching methods and strategies have been designed to enhance active learner interaction with their environment. Crawford and Witte (1999) found that teachers in constructivist mathematics

classrooms actively engaged students in the learning process, and although teachers used various methods, most employed five contextual teaching strategies: relating, experiencing, applying, cooperating, and transferring.

2. 3. Mathematics teaching methods and strategies

Teaching methods are the totality of pedagogical procedures and processes used by the teacher to develop the learners' cognitive, affective and psychomotor domains (TOPTAş, 2012). Bieg et al., (2017) defined teaching methods as specific teaching principles and activities for instruction, such as direct instruction, class discussions, small-group work, pair working, or individual work. Bieg et al. (2017) identified direct instruction as a teacher-centered approach in which the pace of instruction was more likely to be too fast (or too slow) compared to other teaching methods. However, teaching methods and approaches can vary depending on the degree to which student-centered approaches are employed and the student participation required (Bieg et al., 2017). Although there has been a general shift in many education systems from teacher-oriented to student-oriented instruction, (Abdu, Schwarz, & Mavrikis, 2015) cited in Bieg et al., (2017), found that direct instruction was the most frequently reported mathematics teaching method followed by individual work, pair work, and working in small groups, with other methods including demonstration, integration, brainstorming and problem solving.

2. 3. 1. Individual work, pair work and working small in groups

Ohta (2001) claimed that as learners did not have the same strengths and weaknesses, working in pairs could provide mutual scaffolding assistance and by pooling their different resources, they could achieve performances beyond their individual levels of competence (Ohta, 2001). Working in pairs and small groups has been found to be particularly effective for developing math problem-solving skills (Sahlberg & Berry, 2002).

Group work develops mathematics problem-solving skills and a conceptual understanding of mathematics (Esmonde, 2009). Kleopas (2020) recently found that group activities ensured that there was maximum participation from all group members. While group work is not necessarily synonymous with collaboration, Staples (2007) claimed that the group work advantages gave rise to the opportunity to promote collaboration between teachers and students. Teaching methods can also have an emotional value because the social interactions involved in small group or pair work can generate pleasure (Deci & Ryan, 2002).

2. 3. 2. Demonstration

Demonstrations are used to certify efficient teaching and learning. Daluba (2013) defined the demonstration method as a teaching method in which the teacher is the principal actor and the learners watch with an intention to act later, and Mundi (2006) cited in Daluba (2013) defined it as a display or an exhibition usually done by the teacher while the students watch with interest, which generally involved showing how something worked or the steps involved in a specific process. The general purpose of the demonstration method is to illustrate a process to ensure it is easily understood (Ramadhan & Surya, 2017).

The demonstration method has been found to have several advantages. Olaitan (1984) and

Mundi (2006) cited in Daluba (2013) claimed that it saved time, facilitated the material economy, was an attention inducer and a powerful motivator because the students could receive immediate feedback, presented real-life situations as students could acquire real-life skills in situations using tools and materials, motivated students when carried out by skilled teachers, and was useful in exemplifying the appropriate way of doing things. However, if there were poor economic conditions, a scarcity of audio-visual aids and equipment, and poorly trained teachers, demonstration could fail as a teaching method (Kleopas, 2020). Generally, previous studies emphasized that the demonstration method had greater benefits if integrated with other methods.

2. 3. 3. Integration

Davison, Miller, & Metheny (1995) as cited in Koirala & Bowman (2003) claimed that there were five types of science and mathematics integration: discipline specific, content specific, process, methodological, and thematic. Discipline specific integration is related to the different branches within a discipline. However, process integration, which involves experimentation and investigation, is generally employed in science and mathematics. Koirala & Bowmab (2003) believed that the learning cycle and constructivist approaches to teaching could be used for methodological integration to construct teaching units designed around a theme that incorporated various disciplines.

2. 3. 4. Brainstorming

The reason for using a variety of teaching methods in different situations is to enhance learning. Rowan (2014) cited in Al-Shammari (2015) defined brainstorming as a creative group or individual method to obtain information as a list of ideas spontaneously contributed by all members to determine a solution to a particular problem. Rizi, Najafipour, & Dehghan (2013) identified five brainstorming stages: 1)introducing the brainstorming rules; 2) stating the problem; 3) expressing ideas; 4) exhibiting ideas for combination and improvement; and 5) evaluating ideas.(Rizi, Najafipour, & Dehghan, 2013)

Brainstorming has both advantages and disadvantages. Al-Shammari (2015) claimed that brainstorming could assist students identify and come up with real ideas and questions relating to specific problems, incorporate other forms of studying, such as critical thinking, and provide opportunities for everyone including slow learners to participate without criticism. However, brainstorming may sometimes result in only a few ideas as some individuals may have more ideas than the group, and as only one person in the group can give their ideas at a time, the other members of the group might forget the thoughts they had or consider their ideas irrelevant and be unwilling to share.

Kleopas (2020) felt that to better guide learners, teachers should brainstorm mathematical problem skill concepts and learning procedures following the brainstorming procedural steps.

2. 3. 5. Structured problem solving

Takahashi (2009) claimed that problem solving, which is widely used by Japanese teachers to elucidate mathematical concepts, skills, and procedures, was a powerful approach to developing mathematical concepts and skills. In particular, structured problem solving has been a major instructional approach in Japanese mathematics teaching and learning. This

instructional approach starts with students working individually to solve a problem using their own mathematical knowledge, after which there is a classroom discussion on the several possible approaches and solutions (Takahashi, 2009). At the end of the lesson, the teacher combines the ideas, makes connections and summarizes the lesson, which allows that students to reflect on what they have learned.

Japanese structured problem-solving mathematics lessons have three main characteristics: 1) carefully selected cohesive word problems and activities; 2) extensive discussion (Neriage); and 3) emphasis on blackboard practice (Bansho). As the major Japanese elementary school instructional approach, problem solving provides an environment that allows the students to construct their own understanding of the mathematics concepts and procedures (Takahashi, 2009). The open-ended approach, which was first mooted in the 1970s, was further developed in Japan for the teaching of mathematics to develop higher-order thinking in mathematics education, the success of which has become evident in international assessments such as PISA (Hino, 2007)

2．3．6．Lesson study approach

The lesson study approach provides teachers and students with authentic learning experiences (Hart et al, 2011) and a professional development approach to improving mathematics teaching and learning. Putnam and Borko (2000) cited in Hart (2011) found that authentic learning experiences for teachers fostered logical thinking and highlighted the importance of using problem solving as a teaching method. Hart et al (2011) defined lesson studies as being:

- centered around the teacher's interests;
- student focused;
- based on research;
- reflective; and
- collaborative.

Lesson study approaches, which have been guided by Vygotsky's (1979) sociocultural theory, allow teachers to bridge the ZPD. While lesson study approaches have been implemented in other countries such as the USA, Hart et al (2011) claimed that the lack of experienced lesson study practitioners has made it difficult to implement as it requires deep pedagogical content knowledge (Stigler & Heibert, 1999).

2．4．Effectiveness of teaching methods/ strategies

Teachers are key elements in any school and effective teaching is a key propeller for school improvement, with teacher effectiveness generally assessed based on student outcomes; therefore, teacher behavior and class processes are the key to better student outcomes (Ko, Sammons, & Bakkum, 2016). However, defining the effective teacher, effective teaching, and teaching effectiveness is complex and somewhat controversial. Effective teaching needs to be measured against specific effectiveness criteria that are related to general education objectives and particular teaching methods; however, in this study, effectiveness refers to "notions of 'good' or 'quality' education" (Ko et al., 2016)

Anthony & Walshaw (2009) in their *Characteristics of Effective Teaching of Mathematics* claimed that effective mathematics pedagogy:

- acknowledges that all students irrespective of age can develop positive mathematics identities and become powerful mathematics learners;

- is based on interpersonal respect and sensitivity and is responsive to the multicultural backgrounds, thinking processes, and daily life in classrooms;
- is focused on optimizing a range of desirable academic outcomes, such as conceptual understanding, procedural fluency, strategic competence, and adaptive reasoning; and
- is committed to enhancing a range of social outcomes within the mathematics classroom that contribute to the holistic development of students for productive citizenship.

In short, Anthony & Walshaw (2009); Ko et al., (2016); Stigler & Heibert (1999) all believed that the pedagogical content knowledge of the teacher and a grounded understanding of the students as learners were the keys to effective teaching methods.

3. Research methodology

3. 1. Research design, methodology and methods

This study used a case study research approach to generate an in-depth, multi-faceted understanding of the complex issue in a real-life context (Crowe et al., 2011). The case study was descriptive and employed both qualitative and quantitative methodologies and primary and secondary data. The primary data were collected through lesson observations, video recordings, and test analyses, and the secondary data were obtained through curriculum and research study document analyses.

3. 1. 1. Observation

Kumar (2005) cited in Kleopas (2020) described observation as "a purposeful, systematic and selective way of watching and listening to an interaction [between teachers and learners, and between learners and learners] or a phenomenon as it takes place". Therefore, to obtain primary data, four lesson observations were conducted on grade 3, grade 4, grade 5 and grade 6 with different mathematics teachers in Japan, to analyze the teaching methods and strategies being utilized

3. 1. 2. Video analysis

Four pre-recorded mathematics lessons by Namibian teachers, one in grade 4, two in grade 5 and one in grade 6 were analyzed to obtained the qualitative data on the teaching strategies and methodologies being utilized

3. 1. 3. Test analysis

A test was conducted to compare the grounded understanding of the students and the teaching strategies and methodologies in Namibia and Japan. The Japanese curriculum test questions were focused primarily on the two domains of numbers and calculation and quantity and measurement, with a few questions on figures, and the Namibian curriculum test questions were focused on numbers and common fractions and a few questions on measures, mensuration and data handling

A set of 25 multiple choice questions was administered to grade 5 students in both countries. Students were given 40 minutes to answer the questions and the results analyzed to identify the most effective methods and strategies used in Namibia and Japan.

3. 2. Population and sampling procedure

The study population were 8 junior primary mathematics teachers and grade 3 to grade 6 students in Namibia and Japan. As data gathering contributes to a better understanding of a theoretical framework (Bernard, 2011),

purposive sampling was employed to select the junior primary mathematics teachers and learners for this study.

4. Results and discussions

4. 1. Teaching methods and strategies used in Japan

This analysis revealed that a variety of teaching methodologies and strategies were used and the lessons were basically learner-centered with the learners engaged in meaningful learning environments that involved pair work, small group work, and whole class discussions. The elementary mathematics lessons were structured problem solving lessons (Takahashi, 2009), with the learners initially working individually using their own understanding to solve the problem, after which there were pair and group discussions, with the final part being a whole class discussion. Stigler & Hierbert (1999, p. 91) claimed that students learn best by first struggling to solve mathematics problems, then participating in group discussions on the problem and discussing the pros and cons of different methods and the relationships/connections between them. Japanese teachers believe that struggling, making mistakes, and seeing where and why mistakes are made is an essential part of the learning process (Stigler & Heibert, 1999). The group brainstormed ideas, and then combined these ideas and presented them to the whole class, which was in line with the findings in Al-Shammari (2015) that brainstorming enables all learners to participate without censure.

The Japanese elementary mathematics lesson integration of real life and mathematics skills (Hino, 2007) stressed solutions to real world problems to foster problem solving abilities. Hemmi & Ryve (2015) claimed that good teachers should use everyday situations to introduce mathematics ideas.

The curriculum analysis revealed that the elementary mathematics curriculum had four domains: A) numbers and calculations; B) quantities and measurements; C) geometrical figures; and D) mathematical relations (Koyama, 2010). These domains were all taught using thoughtful word problems scenarios. The strong connections between the content and everyday life experiences encouraged the learners to develop their own methods for solving the problem, that is, the design of the problems encouraged the learners to construct their own meaning when learning (Hawkins, 1994).

The Japanese teachers facilitated the whole class discussions by asking thoughtful questions that stimulated the learners to think critically and logically. The keywords and terminologies used in the questioning and problem solving were well defined, and the teachers demonstrated subject expertise and pedagogical knowledge, that is, they appeared to have adopted Vygotsky's ideas because they employed social interactions to maximize understanding. Therefore, as the teachers tended to focus more on methodology, understanding, and proofs and procedures rather than the correct answers, the Japanese classes provided the students with the opportunity to develop their conceptual and procedural mathematical understanding (Hawkins, 1994; Takahashi, 2006).

The students were encouraged to reason after they had solved the problems and to listen carefully to the others' solutions, which were grouped into three categories: 1) Convenient (benri); 2) Accurate (exact) (seikaku); and 3)

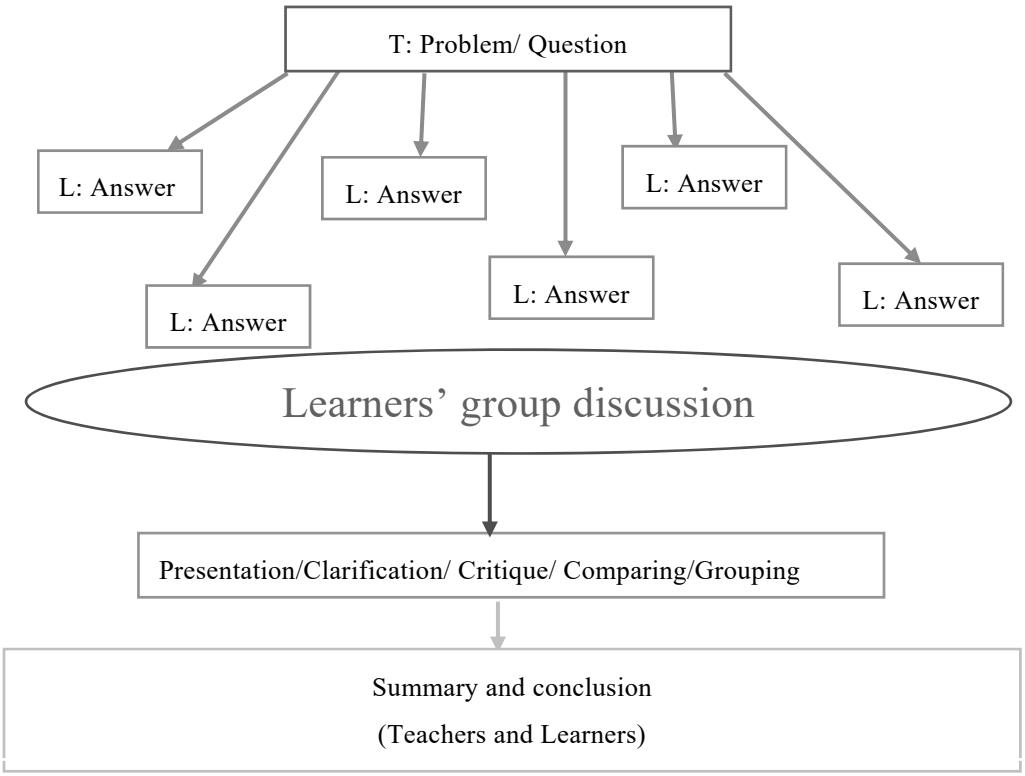

Fig. 1 Japan's class discussion structure

Correct (tadashii). The teacher then combined the learners' ideas and to make the connections, encouraged the learners to reflect on and summarize what they had learned in the lesson.

4. 2. Teaching methods and strategies used in Namibia

Based on the video observations, the mathematics lessons in Namibia included both direct instruction that involved teacher-directed approaches focused on passive learning through lecture and repeated drill and practice activities (Gningue, Peach, & Schroder, 2013), and some but minimal constructivist-informed student-centered learning approaches that made the students responsible for learning, and social engagement (Andersen & Andersen, 2017). Some teachers use student-centered approaches in which the students' interacted with one another and connected new ideas using existing knowledge to construct a meaningful conceptual understanding of the information (Hennessey, Higley, & Chesnut, 2012), but overall brainstorming and demonstration were the main methods used, which were employed concurrently and consecutively in some instances. During the lesson introduction, the teacher stimulated the learners' prior knowledge using brainstorming to make the connections with the new knowledge and sometimes drew concept maps to introduce a new topic. However, most teachers in Namibia used demonstration methods, which are guided by Bandura's social learning or observational modelling and imitation learning theory; therefore, the teacher played a major role in the learning. These findings were in line with the demonstration advantages (Daluba, 2003) that it saves time, requires concrete teaching, and motivates learners when is carried out by teacher with strong pedagogical content knowledge. However, it was observed in some

classrooms that due to poor economic conditions, there were insufficient teaching media and equipment and the teachers were not sufficiently creative to produce handmade models for the demonstrations (Kleopas, 2020).

The National Curriculum of Basic Education produced by the NIED stated that mathematics skills, knowledge, concepts and processes enabled learners to investigate, model, and interpret the numerical and spatial relationships and patterns that exist in the world, which means that it is vital that mathematics, science, technology and commerce be integrated (NIED, 2016). However, there was little evidence that the mathematics teaching and daily life were being integrated as the teachers tended to focus only on the textbooks. Given the multicultural diversity in Namibia, some textbook examples may not always be useful to specific groups of learners. Thadei (2013) found that when teachers used activities that originated from the learners' environment, the learning became more meaningful.

Although the keywords and terminologies used in the questioning and problem solving were defined, the teacher switched from English to the learner's mother tongue/ pre-dominant language when explaining some concepts, rarely encouraged the learners to reason after the problem was solved, and did not initiate further discussion on the same problem to rule out all other possibilities or to explain possible different methods. Instead, activities were given that required the learners to repeat the same procedure as given in the demonstration. Even if the teacher sometimes generated curiosity to encourage the learners to participate, the teacher was only interested in the correct answer and there was no other discussion after the correct answer was determined.

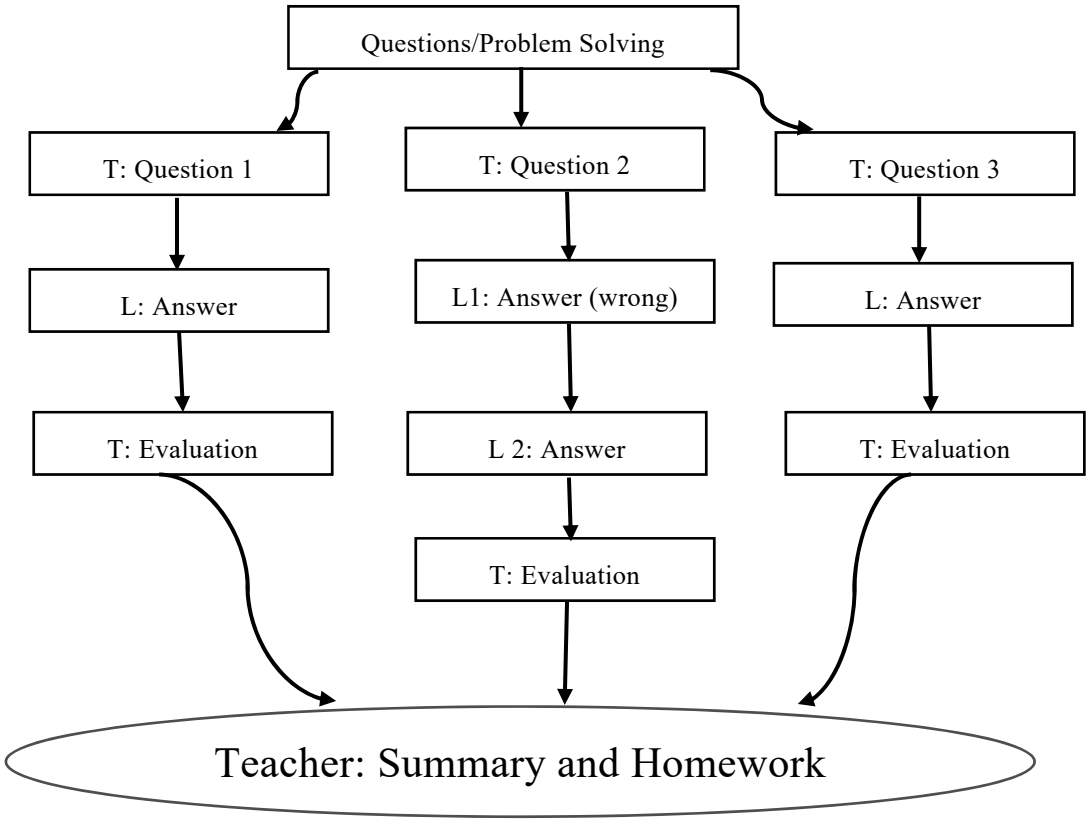

Fig. 2 Namibia's mathematics classroom discussion structure

Questions need to accommodate all learners and therefore should not be competitive as some instruction may be needed for slower learners to help them keep up (Fouze & Amit, 2017). However, as some teachers planned a great deal of activities, there was little time given to exploring all possible mathematical solutions. Therefore, as all learners used the same method as the teacher had demonstrated to solve all activities, even if there was time for discussion, the solutions were the same. Some teachers kept interrupting the learners as they were working on the activities by saying things such a "*... pay attention to question 3....., in question 4b make sure you have the same unit before you calculate...,*" which meant that the learners may not have been able to realize their ZPD (Vygotsky, 1978). The teachers concluded the lessons by highlighting the main lesson content and often gave the learners homework based on the lesson taught.

4．3．Test analysis on Japan and Namibia

The pedagogical content knowledge of the teacher and a grounded understanding of students as learners is the key to teaching method effectiveness (Anthony & Walshaw, 2009; Ko et al., 2016; Stigler & Heibert, 1999). The Japanese students gained an average of 93.1 %, with most learners scoring more than 95 %, the highest being 100 % and the lowest being 76%. Figure 3 shows the results for the Japanese students. The Namibian student performances were satisfactory, with the highest being 76%, the lowest being 36%, and the average being 52.6%, with most being less than 70%, as shown in Figure 4. Table 1 compares the performances per question by the respective students; for example, none of the Namibian students got question 14 correct, whereas 90.2% of the Japanese got it correct. The results generally showed that the Namibian students were struggling with fractions while the Japanese students demonstrated deeper grounded mathematical understanding.

{*Question 14 Convert* $\frac{21}{8}$ *to a mixed number.*

A. $1\frac{2}{8}$ *B.* $1\frac{13}{8}$ *C.* $2\frac{1}{8}$ *D.* $2\frac{5}{8}$ /

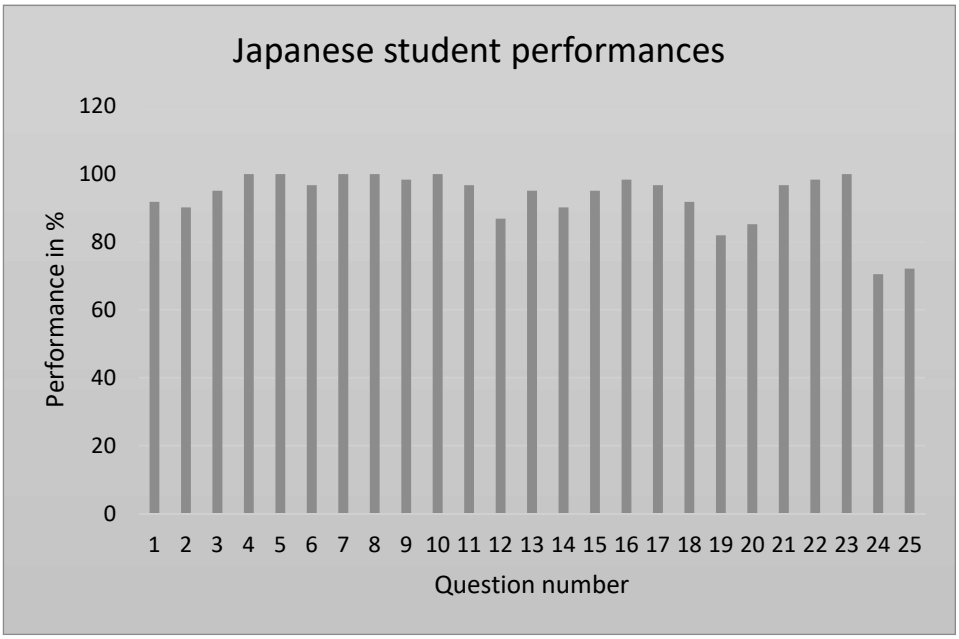

Fig. 3 Japan's performance

Table 1：Percentage performance comparison per question

Questions	Japanese student performances %	Namibian student performances %
1	91.8	100
2	90.2	100
3	95.1	100
4	100	100
5	100	97.2
6	96.7	22.2
7	100	55.6
8	100	33.3
9	98.4	41.7
10	100	77.8
11	96.7	52.8
12	86.9	27.8
13	95.1	50
14	90.2	0
15	95.1	22.2
16	98.4	52.8
17	96.7	27.8
18	91.8	52.9
19	82	22.2
20	85.2	72.2
21	96.7	52.8
22	98.7	75.2
23	100	22.2
24	70.5	41.7
25	72.1	16.7

4．4．Discussion

This study revealed that Japan's mathematics pedagogy was more effective than Namibia's because Japan's teaching focus was more focused on making connections rather than using specific and defined procedures. The application of lesson study and the analysis of classroom practice were found to play an important role in Japan's mathematics pedagogy as they gave teachers the opportunity to analyze how their teaching affected learning, to closely examine those cases in which learning did not occur, and provided the skills they needed to integrate new ideas into their own practice (Stigler & Heibert, 1999). The Japanese teachers were found to focus more on methodology, making connections, and encouraging the learners to construct their own understanding by interacting with their social environment. Japan's mathematics classroom practice was committed to enhancing social outcomes to ensure holistic student development for productive citizenship (Anthony & Walshaw, 2009).

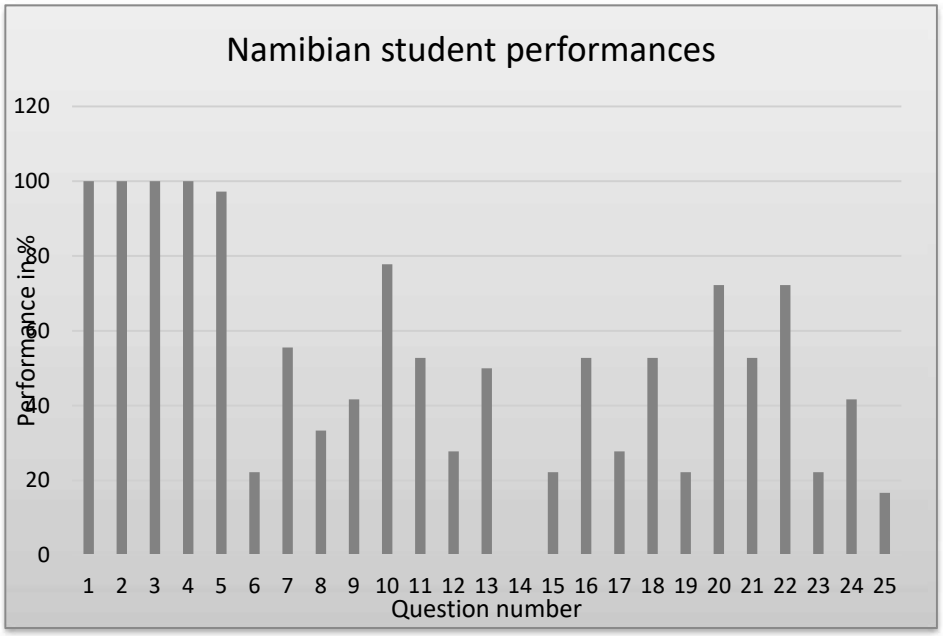

Fig.4 Namibia's performance

Namibia's mathematics pedagogy tended to be based on interpersonal respect and sensitivity because of the need to be responsive to the multiple ethnicities (Anthony & Walshaw, 2009); however, improvements are needed in thinking processes and the realities in everyday classrooms. Namibia's pedagogy was found to be based on set procedures for solving problems, and even though there had been a shift from teacher-oriented to learner-oriented instruction, direct instruction was most frequently used to teach mathematics. The medium of instruction was also a barrier to influential classroom interactions as the teachers switched from English to mother tongue language to expedite explanations. It has been found that language of instruction can be a hindrance when students are attempting to negotiate mathematical meanings in word problems and determining the required mathematical operations (Shilamba, 2012). Namibia is a multicultural, multilingual country in which most people speak one or more of the seven main languages. Bose and Choudhury (2010) cited in Shilamba (2012) stated that language played a vital role in thinking, learning and teaching; therefore, teaching mathematics in a second language (English) at elementary level is challenging as the learners have not yet mastered the language to construct a meaningful understanding of the mathematics concepts and skills in classroom discussion. Mathematics teachers in Namibia have a complex role, as they are expected to devise innovative teaching activities and make use of effective teaching strategies in a context that demands high quality content teaching, but at the same time be sensitive to the multilingual dynamics (Shilamba, 2012). In some cases, student-centered teaching takes time and teachers may not be able to finish the required content.

5. Conclusion

While this study is unable to generalize the pedagogy found in the two countries to all schools in each respective country, it revealed interesting differences between the strategies and methodologies. Even though every country has its own methods for teaching mathematics, brainstorming, demonstration, and group discussions were methods that were used in both countries. Japanese educators have been using a structured problem-solving approach to teach mathematics, which is a learner-centered approach informed by Vygotsky's theory of social constructivism. Japanese teachers employ a variety of methods to encourage the learners to construct their own understanding of the problems However, in Namibia, the learners hesitate when explaining their answers because of the need to speak in another language. Most teachers in Namibia tended to use demonstration as their main problem-solving method, which is guided by Bandura's social learning/ observational learning theory based on imitation and modelling. While this method can yield good results if carried out by skilled teachers, when learning environments are poor and the teachers have little innovation, it can be an obstacle to successful learning.

The strong pedagogical content knowledge of the teacher and the grounded understanding knowledge of learners in Japan meant that Japan's teaching methods and strategies are highly effective. Japanese learners learn by making connections (within disciplines, prior knowledge/everyday life) and use a variety of methods to solve one problem, whereas Namibian learners learn by using set procedures

that minimize the need for critical thinking. Therefore, Namibian elementary school mathematics learning could be strengthened if the Japanese methods were adopted.

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