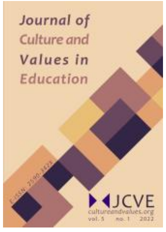

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Lesson-study through Creating Videos by Twinned Teachers: Improving Grade 11 Performance on Rectangular and Cylindrical Prisms

Tšhegofatšo Phuti Makgakga[a]

a. Department of Mathematics Education, and College of Education, University of South Africa, Pretoria, South Africa.
Email: makgatp@unisa.ac.za

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ABSTRACT
Lessons study in the form of created videos by mathematics teachers can be used to improve practice and, therefore, learner achievement. Lesson study is a process in which teachers collaborate to improve their practices by critiquing and examining each other's lessons. This experimental study examined the effectiveness of lesson study using videos created by twinned teachers to improve Grade 11 learners' academic achievement in rectangular and cylindrical prisms. This study was guided by Von Berthalanffy's System Input-Output theory, and a non-equivalent comparison group quasi-experimental design was employed to generate data. A pre-test and post-test were administered to forty (40) learners from the experimental group and thirty-nine (39) from the comparison group. Wilcoxon's Rank-Sum was employed to collect data and to determine the significant difference in the mean scores between the two (2) study groups. The results showed that the experimental group (rank-sum score=2239.5) performed better than the comparison group (rank-sum score=1601.5) with the p-value<0.05 (0.0000) at 95% confidence limit in the post-test. As such, the study recommends that mathematics teachers in rural schools be twinned to create videos and use lesson study to critique and examine their practice with the aim of improving learner academic performance.

KEYWORDS
Lesson study; created videos; mathematics education; twinning; learner performance.

INTRODUCTION

Lesson study (LS) is a teacher professional development approach where a community of teachers work together to improve and reflect on their classroom practices and, consequently, learner cognition. The approach has gained popularity nationally and globally (Baldry & Foster, 2019; Mhakure, 2019). LS originated in Japan over a century ago and has spread widely, particularly in mathematics education (Sakai, Akai et al., 2021). In LS, teachers share their good practices (Richit & Tomkelski, 2022). It has been implemented in the United States of America (USA) (Akiba et al., 2019) and South Africa (SA) (Adler & Alshwaick, 2019).

In LS, teachers plan a lesson together, after which one (1) teacher instructs the lesson in the presence of others. Thereafter, teachers conduct a debriefing session to reflect on the lesson and reformulate the goals in planning for the second cycle (Vermunt et al., 2019). Richit and Tomkelski (2022) similarly state that LS involves the identification of a study question and definition of objectives, the planning of lessons by small groups of teachers working collaboratively, whereafter, a volunteer teacher presents a lesson in the presence of other teachers. And finally, a post-class debriefing session is conducted to reflect on the lesson (Richit & Tomkelski, 2022). Akiba et al. (2019) refer to LS as a teacher learning community (TLC) aiming to improve instruction and learning. LS is found to integrate numerous features such as learner centered approach, modelling and sharing instructional approaches and creating a TLC (Borko et al., 2014). The (ibid) further indicates that it helps in setting goals and providing opportunities for teachers to continuously learn in a sustainable way.

LS has gained traction in mathematics education to enhance pedagogical practices. SA is one of the countries that have adopted this approach and have established teacher learning communities. TLC is a larger movement, of which LS forms a part. Adler and Alshwaikh (2019) investigated how LS with two (2) secondary school mathematics teachers influenced choosing and using examples during the lessons. Mhakure (2019) investigated the effectiveness of LS with mathematics teachers in one (1) school and established that it impacted teacher pedagogical practices. Helmbold et al. (2021) studied the impact of LS on primary school mathematics teachers and found that the approach positively affected content knowledge, pedagogical content knowledge, general professional development and creative teaching. Although it is expected that teachers visit the volunteer teacher to observe the lesson, LS can also use videos.

To support LS, a platform or popular smartphone applications where people share, upload and comment is needed (Mariziri, et al., 2020; Pratma, 2020). Almurashi (2016) views videos as online material that can be integrated into teaching and learning. Videos allow learning without time restrictions and provide active, constructive and interactive learning opportunities (Ebied et al., 2016). They are also viewed as a pedagogical tool providing evidence-based teaching support (Nacak et al., 2020). In this study, a video-sharing platform was used as the focus of LS. Another focus was on teachers who participated in the twinning project.

Twinning is a partnership of two (2) or more schools to share skills and knowledge, strengthen staff involvement, and provide peer mentoring and support to counter school isolation (Oldham et al., 2018). Chaidi and Drigas (2022) view twinning as a development and improvement of social communication, interaction and empowerment of learners and teachers. In this study, “twinning” refers to the collaboration of two (2) teachers and the researcher in implementing LS to investigate whether the use of videos in the twinning process might yield positive results in learner performance in the measurement of rectangular and cylindrical prisms in Grade 11.

In SA, studies have been conducted on LS focusing on teacher pedagogical practices. However, there is a dearth of studies focusing on rural schools with twinned teachers using self-created videos to teach rectangular and cylindrical. This study is unique in that a quasi-experimental design was used as online technologies gained popularity. In this study, teachers used video-recorded lessons to critique their teaching approaches and strategies on surface area and volume of rectangular and cylindrical prisms. This enabled the researcher to measure the implementation of LS using created videos in the experimental group in a rural school, as the study wanted to ascertain whether LS with the twinned teachers could improve Grade 11 learner performance in rectangular and cylindrical prisms. This measurement topic incorporated the surface area and volume of the two (2) classifications of prisms. The aim of the study was to ascertain the effectiveness of LS using created videos to improve Grade 11 learner performance in the surface area and volume of rectangular and cylindrical prisms. For this study to achieve this objective, the researcher tested the null hypothesis that,

$H_{(0)}$: *LS using videos in a twinning project has no significant effect on the improvement of performance in the Grade 11 topic of rectangular and cylindrical prisms focused on surface area and volume*

This null hypothesis was tested against the alternative hypothesis that,

$H_{(1)}$: *LS using videos has significant effect in teaching Grade 11 surface area and volume of rectangular and cylindrical prisms by the twinned teachers.*

The study supported the alternative hypothesis that using LS created videos significantly affects learner academic achievement in surface area and volume of rectangular and cylindrical prisms. The study revealed that the implementation of LS using created videos (the improved teacher pedagogical practices) positively impacts learner performance.

Related literature pertaining to LS and videos is also presented. System Input-Output Theory and Teacher Learning Communities are integrated to provide a framework for this study. These and the research methodology are discussed in response to the hypotheses tested. Finally, suggestions and recommendations to mathematics teachers, curriculum advisors and developers are made.

Limitations

This study focused on Grade 11 mathematics learners in the Limpopo province of SA in the second semester of the 2022 academic year. The inclusion of other research sites could yield different results. Furthermore, the data set used for analysis had no significant covariates. Future studies may incorporate these additional features in the research design.

Theoretical lens

Von Berthalanffy's (1950) Input-Processing-Output (IPO) and Teacher Learning Communities (TLCs) construction model by Cochran-Smith and Lytle (1999); Louis and Marks (1998) underpin the study. The two (2) theories examine the effect of using LS with the twinned teachers in the teaching of Grade 11 rectangular and cylindrical prisms. The IPO model used learners as inputs exposed to new strategies. For the "processing" stage TLCs framed the implementation of LS using created videos to plan lessons, observe one teacher's lesson and conduct a debriefing session to enhance learners' output (results).

System Input and Output Theory

Von Berthalanffy proposed the System Input-Output theory in the 1950s. The theory requires a certain task to be processed to transform inputs into outputs, and it is termed the Input-Output (IPO) model. In the processing stage, all tasks need to work in harmony to affect the outputs. This model maps the repeated input, throughput, output and feedback cycles to get the required results. The system receives the input from the environment, processes it (throughput), and releases the output to restore equilibrium (Katz & Kahn, 1966; Von Berthalanffy, 1951). The process is the interactions between the teachers and the learners during LS to achieve the desired outputs. Whereby the process can be inferred as one of the factors in the change that will be observed in the output.

In this study, the inputs are learners taught using a traditional approach, with less participation. The two (2) teachers are twinned to share teaching practices using LS to teach rectangular and cylindrical prisms. This theory depends on the environment where the transformation processing occurs to influence the output. The transformation processing in this study took place in a Grade 11 mathematics classroom where twinned teachers implemented LS to improve their practice and thereby enhance learner performance (output).

Teacher Learning Communities

The current study also adapted the TLC features to complement LS. In TLCs, teachers share norms, values and practices to support instruction and improve learners' performance (Cochran-Smith & Lytle, 1999; Louis & Marks, 1998). There are five (5) common themes based on social community theories; interaction and participation, interdependence, shared interests and beliefs, concern for individual and minority views, and meaningful relationships. Stoll et al. (2006) identified five (5) characteristics of TLCs: collective responsibilities, shared vision and values, reflective professional inquiry, group learning and collaboration. Standard Professional Learning, Learning Forward (n.d.) describe TLCs with three (3) characteristics: collective learning responsibilities, commitment to continuous improvement and alignment of individuals, teams and school system goals.

The common grounds for these definitions are that teachers work together to achieve a common goal, where different views are valued and promoted (Akiba et al., 2018). The study helped the researcher to understand how the twinned teachers implemented LS through created videos to teach rectangular and cylindrical prisms to improve performance in the underperforming school. In implementing LS, the study observed how teachers formulated lesson objectives, planned lessons together, observed each other's lessons and conducted debriefing sessions after lesson presentations.

RELATED LITERATURE

The literature reviewed in this study focused on LS, videos in education and the mathematical topic of rectangular and cylindrical prisms.

Lesson study as a strategy for teaching

As earlier indicated, LS is a strategy for teachers to collaborate in the study of mathematical content, discuss learning objectives, plan lessons together, observe the presented lessons and reflect to improve the teaching and learning (Capone et al., 2022). Buchard and Martin (2017) propose the generic process of LS as recruiting participants, choosing the lesson's topic, planning lessons together, researching the lesson's aspects, and discussing and sharing the outcomes after the debriefing sessions. Whilst, Sintawati et al. (2019) postulate that LS is needed to build communities. The (ibid) established that learner performance, learner-learner interaction, learner-teacher interaction, learning materials and classroom are essential during teacher collaboration.

Sintawati et al. (2019) used the quasi-experimental design of a pre-test and post-test in a one group design to investigate the significant effect of LS with mathematics pre-service teachers on ethnomathematics. The (ibid) established that LS had a significant effect on learner performance. Mutaruntinya et al. (2020) concur that the implementation of LS significantly affects the quality of teaching and learning and improves learner academic achievement and teacher competencies. LS enhances self-directedness beyond the classroom and can deepen learner knowledge and understanding of mathematical concepts (Elliot, 2006).

Furthermore, Alamri (2020) found LS is effective in enhancing mathematics teacher pedagogical practices and learner performance. Alsaeed (2022) contends that if LS is carefully planned, it can positively impact teacher competencies and learner academic performance The author further indicates that LS allow teachers to understand different ideas and the nature of the concepts they incorporate into their lessons. LS was effective in enhancing teacher content knowledge, pedagogical content knowledge, general professional development and learner performance (Helmbold et al., 2021). This finding was hoped to be emulated in this study.

Use of video lessons in education

Video lessons in education are a pedagogical tool that can enhance teaching and learning support and inform evidence-based discussions (Kabel et al., 2021; Nacak et al., 2017). The use of videos allows teachers and learners to watch, share, comment and interact to generate knowledge (Adu et al., 2022; Pratama et al., 2020). Teachers and learners can access videos anywhere and anytime; the content can be shown, repeated, stopped and completed at will (Pratama et al., 2020). Whitton and Maclure (2017) highlight some points on the use of videos, such as psychological benefits (learning attitude and motivation), cognitive benefits (learning, memorisation) and the visualisation of knowledge.

Researchers have highlighted the importance of using videos in education (Ebied et al., 2016; Alkhudaydi, 2018; Bozzetto-more, 2014; Stockwell et al., 2015). Ebied et al. (2016) found that videos are effective as teachers and learners can exchange views and give each other feedback. The use of videos was found to enhance discourse, collaboration and engagement (Bozzetto-more, 2014). According to Alkhudaydi (2018), the benefits of videos in education include generating interest in the subject, improving content, changing attitudes, fostering creativity, increasing collaboration, decreasing anxiety and increasing understanding of the subject. The elements that impact engagement, targeted learning goals, important ideas and concepts, and factors that promote learning need to be identified when using videos (Stockwell et al., 2015).

Rectangular and cylindrical prisms

Surface area and volume are 3-dimensional (3-D) basic measurements studied in primary and secondary school mathematics (Baiduri, 2019). The area of 2-D shapes in measurement assists learners with the foundation of multiplication, fractions and algebraic multiplication, which is also the basic knowledge for surface area and volume. For learners to grasp the surface area and volume concepts, they need the foundation of the area concept. In other words, 2-D shapes are the building blocks of 3-D shapes (Chipambo & Mtsi, 2021). The volume of 3-D shapes provides a variety of contexts to expand learner knowledge about geometric reasoning, arithmetic reasoning and spatial planning (Mason, 2012).

Studies revealed that learners have difficulties in solving problems based on length, area and volume (Baiduri, 2019; Strutchens et al., 2003). Baiduri (2019) showed that learners experience difficulties when solving surface area and volume. Strutchens et al. (2003) found that learners only focus on using formulas to calculate surface area and volume without a comprehensive understanding of these measurement concepts. Mason (2012) identified challenges learners experience in learning the measurement concepts, such as (a) counting surfaces/seeing units as cubes, (b) treating 2-Ds as 3-Ds, (c) incorrectly counting cubes in 3-D arrays and (d) confusing the volume concept with the concept of surface area. In their study, Chipambo and Mtsi (2021) explored surface area errors it was revealed that learners confuse 2-D shapes with 3-D ones and calculate the surface area as a perimeter and use the volume formula to calculate surface area. The authors suggested that teachers expose learners to difficulties in learning 2-Ds and 3-Ds as this can inform teaching and empower learners to learn mathematical concepts.

RESEARCH METHODS

The aim of the study was to ascertain whether LS using created videos would enhance Grade 11 learner performance in the measurement topic of rectangular and cylindrical prisms, with a focus on surface area and volume. The study espoused a non-equivalent comparison group quasi-experimental design to measure the difference between pre-test and post-test, between the experimental group and the comparison group, and subsequently decide the significance. Creswell and Creswell (2018) and Williamson and Johanson (2018) postulate that in this type of design, the selected experimental and comparison groups take the pre-test and post-test, and only the experimental group received treatment.

The study was conducted between July and September 2022 in one rural secondary school underperforming in mathematics in the Polokwane district of the Limpopo province. The school complement consisted of one principal, one deputy principal, three heads of departments (HODs) and twenty-one teachers, including five mathematics teachers. The school has an enrolment of about 900 learners. The school was chosen as it participated in the twinning project that involved two schools that performs differently in mathematics. The two teachers implemented LS using created videos in the experimental school to enhance learner learning. This study is notable as the effect of using LS using videos created by the twinned teachers is somewhat under-evaluated.

This study comprised Grade 11 mathematics teachers and learners as participants. Two teachers (both males from the selected schools participated in the twinning project) and 40 learners (23 females and 17 males between the ages of 16 and 19) and one male teacher and 39 learners (21 females and 18 males between the ages of 16 and 21) from the comparison group. The study used a pre-test before the implementation of LS using created videos and a post-test after the treatment to measure the significant effect between the pre-test and post-test between the two study groups. The question items were adapted from the previous Grade 11 mathematics examination question papers on the surface area and volume of rectangular and cylindrical prisms focusing on surface area and volume.

The researcher sought permission to conduct the study from the Ethics Committee chairperson in the College of Education under the Department of Mathematics Education engaged scholarship project, ethical clearance certificate number 22/02/09/90197607/14/AM. Permission was also sought from the three teachers, the teacher from the comparison group and the twinned teachers prior to conducting the study. The primary aim of the study was explained to participants, and participation was declared voluntary. The teacher from the comparison group only assisted in administering the pre-test and post-test. Table 1 shows the participating teachers' biographical information: Their names and schools were pseudonyms to protect their identities and ensure their anonymity.

Table 1.
Teacher biographical information

Pseudonym	Gender	School	Mathematics Education qualifications	Mathematics teaching experience	Training Institution
Lesiba	Male	Experimental group	Bachelor of Education major in Mathematics Education	8 years	University of Venda
Matome	Male	Comparison group	Bachelor of Education major in Mathematics Education	10 years	University of Limpopo

Data collection procedures

Prior to implementing LS through created videos in the experimental group, the researcher administered a pre-test in the two groups on the same day at the same time. The two teachers assisted in invigilating learners during the administration of the test, which took place after school to avoid interrupting the smooth running of the school programmes. The researcher then marked the scripts a day after the administration of the test. The two teachers and the researcher introduced an LS in the experimental group. The teachers and the researcher formulated the lesson objectives and planned lessons as a collective. The teacher in the experimental school presented those lessons creating videos for reflection as it was difficult for another teacher to travel to the other school. The teachers and the researcher viewed the video lessons. They critiqued them to give the teacher in the experimental group feedback for improvement, and the teacher returned to re-teach using strategies suggested during debriefing sessions. The LS took six weeks, and lessons were conducted twice a week in the afternoon. After the treatment, the researcher then administered the post-test in the two groups to measure the effect of the treatment between the pre-test and post-test if the hypothesis was supported LS using videos has a significant effect in teaching Grade 11 surface area and volume of rectangular and cylindrical prisms by the twinned teachers.

The validity of the learner assessment results on surface area and volume of rectangular and cylindrical prisms was established (Creswell & Creswell, 2018). After marking the scripts, the researcher gave Lesiba and Matome the scripts for verification. The organised data was given to a professional statistician to analyse the data using Stata Release computer software. Statistical analysis data from the statistician was given to the three teachers for confirmation and approval.

Data analysis procedures

Microsoft Excel was used to capture, organise and manage the data gathered from the pre-test and post-test scripts (Microsoft, 2013). Mann-Whitney Wilcoxon Rank-Sum test was used to determine the significant difference in the mean scores between the two study groups. A t-test was also used to compare the rank-sum scores and to determine the significant difference using the p-value. So, the rank-sum score was used to determine the results of the treatment determined at a 95% confidence limit. Note, the results are declared significant if the probability value (*p-value*) is less than 0.05, that is, there is a 0,05 chance that the result could have been attained by chance.

RESULTS

This study intended to ascertain whether the LS using created videos enhances Grade 11 learner performance in the measurement topic of rectangular and cylindrical prisms, focusing on surface area and volume. If the $p-value > 0.05.\text{The}$ outcomes are not significant; conversely, if the $p-value < 0.05$, then the outcomes are significant.

The rank-sum score, used to test the significant difference between the two groups, is determined per questions (Q1 – Q3.3, Q4 – Q7 and summary of results Q1 – Q7.2). Table 3 presents data collected from Q1 – Q3.3, assessing learners on understanding surface area and using the formula to solve problems.

Table 3.

Q1 – Q3.3 test results

	Pre-test			Post-test		
School	obs	rank sum	expected	obs	rank sum	expected
Experimental group	40	1740	1869	40	2188.5	1870.5
Comparison group	39	1935	1806	39	1666.5	1870.5
combined	79	3675	3675	79	3741	3742
Prob = 0.2467				Prob = 0.0001		

Table 3 depicts no significant difference between the two groups when learners solve surface area and volume of prisms, experimental group's ($rank - sum\ score = 1740$) and the comparison group's ($rank - sum\ score = 1935$) with the $p - value > 0.05\ (0.2467)$ at 95% confident limit. Though the two groups showed no significant difference in the pre-test, the comparison group showed higher rank-sum scores than the experimental group in the pre-test results.

Conversely, the post-test results showed a significant difference between the experimental and comparison group confidence limits. The experimental group showed a higher rank-sum score than the comparison group in the post-test after the intervention.

Table 4.

Q4 – Q7 test results

School	obs	rank sum	expected	obs	rank sum	expected
Experimental group	40	1793	1839	40	2074	1870.5
Comparison group	39	1852	1806	39	1668	1870.5
combined	79	3645	3645	79	3742	3741

Prob = 0.9078 Prob = 0.0031

Table 4 depicts no significant difference between the experimental group) and the Comparison group's confidence limit in the pre-test. Though the two groups exhibited no significant difference in the pre-test, the comparison group showed higher rank-sum scores than the experimental group.

Conversely, the post-test results depicted a significant difference between the two groups, the experimental group's $(rank - sum\ score = 2074)$ and the comparison group's $(rank - sum\ score = 1668)$ with $p - value < 0.05\ (0.0031)$ at 95% confidence limit. However, the experimental group showed a higher rank-sum score than its counterpart in the post-test after the intervention.

Table 5.

Q1 – Q7.2 test results

	Pre-test			Post-test		
School	obs	rank sum	expected	obs	rank sum	expected
Experimental group	40	1788.5	1870.5	40	2239.5	1870.5
Comparison group	39	1972.5	1890.5	39	1601.5	1870.5
combined	79	3761	3761	79	3741	3741

Prob = 0.3730 Prob = 0.0000

Table 5 depicts no significant difference between the two groups in overall pre-test results, experimental group's $(\boldsymbol{rank - sum\ score = 1788.5})$ and comparison group's $(\boldsymbol{rank - sum\ score = 1972.5})$ with the $\boldsymbol{p - value > 0.05}$ $(\boldsymbol{0.3730})$ at $\boldsymbol{95}\%$ confidence limit. Despite the two groups having no significant difference, the comparison group showed a higher rank-sum score than its counterpart in the pre-test prior to the intervention.

The post-test results depicted a significant difference between the experimental and comparison groups's $(\mathbf{rank-sum\ score=1601.5})$ with the $\mathbf{p-value<0.05}$ $(\mathbf{0.0000})$ at $\mathbf{95}\%$ confidence limit. It indicates that the experimental group showed a higher rank-sum score than its counterpart after the intervention.

DISCUSSION and RECOMMENDATION

This study has ascertained the effectiveness of LS using created videos to inform the teaching of surface area and volume of rectangular and cylindrical prisms and to improve learner performance. The results showed that the experimental group significantly improved performance in the post test. The study by Sintawati et al. (2019) found that the use of LS depicted a significant effect towards improving the quality of teaching and learner performance. Helmbold et al. (2021) add that the use of LS enhances teacher content knowledge, pedagogical content knowledge and general professional development and therefore improves learners' performance.

Alamri (2020) hypothesised that in mathematics, the use of LS correlates with learner performance. However, the relationship should not be subscribed to the principle of causality. Though there is substantial evidence that the use of LS in the teaching and learning of mathematics improves performance, some learners appeared to have difficulties when solving mathematical problems, such as the surface area and volume of the rectangular and cylindrical prisms. As such, it can be concluded that the reasons for the challenges in surface area and volume may vary from learner to learner.

Although this study did not focus on why learners experience challenges in solving surface area and volume, Strutchens et al. (2003) reveal challenges as the use of formulas to calculate surface area and volume without a comprehensive understanding of surface area and volume measurement concepts. Learners confuse 2-D shapes with 3-D, confuse volume with surface area, calculate the surface area as perimeter and use the volume formula to calculate surface area (Chipambo & Mtsi, 2021; Mason, 2012). Mason (2012) found the challenges of learners in learning measurement concepts as counting surfaces/seeing units as cubes, incorrectly counting cubes in 3-D arrays and confusing volume with surface area concept.

The findings of this study showed that some learners in the comparison group performed well; the reason for the better performance is unknown. One reason may be that the learners' self-directedness has been enhanced beyond the classroom, and they have deep mathematical knowledge and understanding (Elliot, 2006). However, the findings in the experimental group may be argued that the improved learner performance correlated highly with the implementation of LS using created videos. The question remains as to what contributed towards the better performance of some of the learners in the comparison group as they had not participated in the project. Similarly, one can investigate why some learners perform better while most struggle in learning the surface area and volume of rectangular and cylindrical prisms in the comparison group. Future research can be conducted on teacher perceptions and experiences of LS using created videos in teaching surface area and volume of rectangular and cylindrical prisms in the experimental group.

CONCLUSION

The findings depict that there is enough evidence to conclude that the significance of LS using created videos impacted the post-test results. Therefore, the findings of this study may account for the effects of implementing LS using created videos in improved learner performance. The study revealed a higher rank-sum score in the post-test as compared to the pre-test results in the experimental group. The system input-output theory supports the notion that learners come to class with experiences. During the period from input to output, learners were equipped by their teacher who was involved in LS and interacted within a Teaching Learning Community. This experience, in part had an effect in improving the output (learner performance in surface area and volume of rectangular and cylindrical prisms).

Although the implementation of LS using created videos to improve learner performance in surface area and volume may be logical, it may not be enough to solely apply this intervention without considering other strategies. Teachers may be advised to apply other strategies, models and frameworks to compensate for all factors to account for enhanced variation in learner performance. In dealing with learners who struggle with mathematical concepts like surface area and volume, uniform teaching is not always desirable in the classroom. Learners need to be supported and motivated to learn mathematics, as such, any practice not informed by theory may likely prove an exercise of self-deception (Letsoalo & Makgakga, 2022). For effective teaching and learning, one needs to support learners, have contributions from the school perspective, and employ appropriate strategies that can improve learner performance and enhance teacher content knowledge, pedagogical content knowledge and professional development.

Conflict of Interest

I declare no conflict of interest, and the study had no financial assistance from any organisation.

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