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ABSTRACT

This study focused on enhancing mathematics lessons on word problems using storytelling pedagogy. A quasi-experiment with a pretest-posttest design with a control group was adopted. The study purposively selected 120 primary two learners as participants for the study. Mathematics achievement test on word problems of adding up to 100 (with a Kuder-Richardson reliability coefficient of 0.73) was the instrument for data collection. The data collected were analysed using SPSS version 20.0 software in two descriptive (mean and standard deviation) and inferential statistics (ANCOVA). The results revealed that the mean achievement score of young learners who learnt word problems of adding up to 100 using storytelling pedagogy was significantly higher than those taught using the conventional chalk-and-talk teaching method (without storytelling), implying that storytelling is very effective in enhancing performance in mathematics word problem-solving lessons. This study also revealed that the mean achievement score of learners using storytelling as a pedagogy was not significantly influenced by gender. It was recommended, among others, that the storytelling technique be employed in lower primary schools to enhance the mathematics achievement of learners.

Keywords: Mathematics, Storytelling, Teachers, Word Problem, Primary Schools, Mathematics Pedagogical Content Knowledge (MPCK)

INTRODUCTION

Teaching mathematical concepts to young learners in the lower primary school using the conventional chalk-and-talk teaching method can be challenging for some teachers (Unodiaku, 2012). The abstract nature of mathematics makes it difficult for young learners to understand specific concepts, such as addition and subtraction in algebra (Garderen, 2004). More specifically, in Nigeria, most primary school learners struggle to understand some mathematical concepts, leading to poor mathematics performance at their entrance examinations to high schools. According to Zazkis and Liljedahl (2019), young learners struggle to solve word problems, which are an essential component of the international mathematics curriculum. Word problems are described as exercises in mathematics presented with appropriate information about a problem in a textual format instead of mathematical notations (Boonen, de Koning, Jolles, & Van der Schoot, 2016). Word problems are perceived as narratives or stories involving mathematical calculations, with significant textual and contextual information on the problem (Scheibling-Sève, Pasquinelli, & Sander, 2020).

Gerofsky (2010) noted that there is a relationship between mathematics, language and reality; hence young learners' ability to solve mathematics word problems is evidenced in learner's ability to assimilate these relationships. Another explanation as postulated by Verschaffel, Schukajlow, Star, and Van Dooren (2020), is that word problems are descriptions of problematic situations presented in an academic setting in the form of mathematical operational statements from which numerical data are derived. Verschaffel et al. (2020) further noted that word problems are different from sums presented in written form, such as $6+9=?$; $4c \times 7=?$ and How much is 50 divided by four? What are the means of 52, 14, 23, and 20? Although most Nigerian teachers are used to using the chalk-and-talk pedagogical approach to teaching mathematics, the researcher believes that learners' poor mathematics performance can be bridged using storytelling pedagogy. Therefore, the need to use storytelling to facilitate word problems in mathematics is the niche for this research because anecdotal evidence shows that learners in lower primary school classes struggle to grasp word problems in mathematics.

The art of story and storytelling

Storytelling indisputably emanates from stories, which are as old as humanity because humans have always had ways of communicating among themselves about issues bothering their lives and coexistence. While Yeltekin (2019) described a story as written and unwritten pieces of literature that may contain fictional or real-life experiences that help humans understand the world in which they live, McDrury and Alterio (2002) avowed

storytelling as a way of knowing. Similarly, Forest (2007) mentioned storytelling as a traditional method of teaching and learning. Furthermore, Moon (2010) noted that storytelling can be used to facilitate learning as it can be presented in various forms, such as cartoons, written, spoken, mimed, and acted, among many others. Moon (2010) noted that human lives and cultures are characterized by stories that become a veritable tool for teaching and learning. This is because storytelling involves narratives, creative writing, critical incidents, life history, anecdotes, scenarios, case studies, illustrations, and examples.

In the past, storytelling was the occupation of notable people in the community, who were considered skillful in using appropriate language to communicate their narratives to the people (Egan, 1989). Such storytellers develop their oratory, mental, and visual skills to enable them to simplify complex issues to the level of their audience's understanding (Egan, 1989). Leaders of religious, military, political and educational settings have used storytelling in the forms of parables, myths, legends, fables and actual life experiences to make their audience understand the messages they convey (Andrews, Hull, & Donahue 2009). Storytelling skills in the past have become the determinant factor for appointing leaders in some communities, because most storytellers were seen as orators (Egan, 1989). Andrews, Hull, and Donahue (2009) alluded that in recent times, storytelling, whether fictional or non-fictional, has become a significant tool teachers can use to facilitate teaching and learning.

Although most teachers appreciate the use of storytelling in teaching, they are not intentional in its application, as storytelling spontaneously occurs in their teaching process (McDrury, & Alterio 2002). However, researchers are concerned about teachers' intentional application of storytelling as a teaching technique (Lemonidis & Kaiafa, 2019; Khodabandeh, 2018). For this reason, the researcher argues for the use of storytelling in teaching young learners word problems in mathematics.

Importance of teaching word problems to young learners using storytelling

Thus, the importance of word problems in mathematics curricula cannot be overestimated. "Problem solving is the cornerstone of school mathematics. Unless young learners solve problems, the facts, concepts, and procedures they know are of little use" (National Council of Teachers of Mathematics, 2000:181). Similarly, Bates and Wiest (2004) argued that learning mathematics becomes futile without the real-world application of mathematical procedures. They asserted that word problems are an important means of contextualizing mathematics in everyday life. This is because word problems do not allow rote learning, as learners are immersed in critical thinking to understand and solve the word problems presented to them.

Developing critical thinking and problem-solving skills is vital for young learners to effectively function in a rapidly changing world. When critical thinking and problem-solving skills are intertwined with the storytelling approach to learning, it assists young learners in analyzing problematic situations and recommending possible solutions to problems (Clarence, 2018). According to Kallet (2014), thinking critically is more than the accumulation of facts and knowledge; rather, it is an intense, thoughtful reflection on problems that leads to the generation of the best possible solution. Storytelling, as an approach in teaching, is usually thought-provoking, thus enhancing learners' critical thinking skills. According to Halpern (2014), critical thinking implies a clear, logical, and rational understanding of connections between ideas. It involves brainstorming, analyzing ideas, solving puzzles, connecting dots, and making deductions (Halpern, 2014). Paul and Elder (2019) reiterated that, to enhance critical thinking skills (mathematics), teachers must consider strategies such as debates, group discussions, solving puzzles, and solving numerical problems, among others. This implies that the appropriate integration of pedagogy and content is a veritable asset in teachers' hands to facilitate learning. Therefore, critical thinking is a precursor to creative ideas and innovations; hence, it is necessary to encourage and reinforce young learners.

Although most learners are unaware that creativity lies within the circumference of mathematics, creativity is perceived to be associated with arts subjects alone. However, the storytelling approach to learning is an effective way for learners to develop creativity through mathematics because their sense of visualization and imagination are fully involved in the learning process (Egan, 2005; Forest, 2007). Whereas the presentation of numeric equations may be problematic for learners, adopting the storytelling approach enables learners to explore the dimensions of the equation and thus solve problems more creatively (Bates, & Wiest, 2004). Creativity goes beyond classroom parameters into real-life situations; for this reason, word problems through the storytelling approach enhance learners' creativity beyond classroom activities (Cekaite, & Björk-Willén, 2018; Cumming, & Eaves, 2018). Teachers who believe that learners learn differently inspire their learners through the creative application of storytelling in teaching word problems because the approach is always appealing and friendly to learners of all ages.

Undoubtedly, storytelling enhances learners' comprehension of the learning content. Reading and comprehending texts, identifying questions needing answers, and solving questions are essential components of mathematical word problems that enhance learners' comprehension (Bernardo, 2005). Comprehension is an essential aspect of deep learning. Other than memorization, which may be superficial, comprehension broadens the understanding of learners on any subject matter. According to Vilenius-Tuohimaa, Aunola, and Nurmi

(2008), factors such as lack of comprehension and linguistics contribute to learners' inability to accurately solve word problems in mathematics. However, Lemonidis and Kaiafa (2019) noted that storytelling in mathematics is an effective instructional tool that sustains learners' interest, enhances comprehension, and makes learning pleasant. Furthermore, they noted that storytelling provides an authentic context for learners to comprehend the procedure for solving complex mathematical concepts (Vilenius-Tuohimaa, Aunola, & Nurmi, 2008). However, learners in their characteristics still experience some unique challenges in learning word problems, mainly because their cognitive processes are developmental.

Challenges of teaching and learning word problems

Thus, word problems serve as a catalyst for developing and enhancing learners' mental skills, logical analysis, and creativity in problem solving. Boonen et al. (2016) further noted that mathematical word problems enhance mental representation and reading comprehension skills. However, Garderen (2004) found that learners experience difficulty in comprehending word problems because of the problematic linguistic vocabulary used to present mathematical ideas in word problems.

Gooding (2009) surveyed difficulties young learners faced regarding solving mathematics word problems and categorized them into five concerns, namely: (a) "reading and understanding the language used within a word problem, (b) recognising and imagining the context in which a word problem is set (c) forming a number sentence to represent the mathematics involved in the word problem (d) carrying out the mathematical calculation (e) interpreting the answer in the context of the question" (Gooding, 2009:31-32). Besides these difficulties is the general phobia of mathematics, which is assumed to emanate mainly from teachers' pedagogical choices and approaches.

Learners with phobia of mathematics can develop a love for numeracy when teachers learn fun and jumpstart math learning through storytelling. According to Goral and Gnadinger (2006), learners are captivated when teachers speak their math stories aloud while making eye contact with the learners instead of reading math stories from a book. Furthermore, learning mathematics through storytelling dispels learners' fears of mathematics when teachers use stories that appeal to their circumstances. In doing so, teachers may adopt a true life story, myth, illustrations, spoken or written, mime, drama, or filmed stories to enhance their understanding of mathematics lessons (Moon, 2010). These strategies aid young learners in making sense of mathematics learning.

Theoretical Framework

Over the years, the understanding of what teachers know (content knowledge) and the practical application of what teachers know (pedagogical knowledge) have remained a concern for most researchers. Shulman became one among other researchers who investigated and introduced new ways teachers' content knowledge and pedagogical content knowledge can be integrated for the optimal enrichment of learners (Shulman 1987). However, teachers who, perhaps having a full grasp of the content, are bedeviled by their lack of knowledge of how to apply appropriate pedagogical strategies to the learning content they know. Therefore, they struggle to facilitate learners' critical thinking and problem-solving skills.

Shulman (1987) regards knowledge of subject matter as content knowledge (CK) and knowledge of the strategy for imparting subject-matter content as pedagogical content knowledge (PCK)—in the case of mathematics, mathematics content knowledge, and mathematics pedagogical content knowledge (MPCK), respectively. Teachers' lack of MPCK has been shown to lead to poor mathematical performance on examinations (Fahlberg-stojarn ovaska & Stojanovsks, 2009; Iji, 2002). Other knowledge required by teachers per Shulman (1987) are curriculum knowledge, general pedagogical knowledge, knowledge of learners' characteristics, knowledge of the educational context, and educational ends, purposes, and values. This is not discussed further here.

Shulman argued that teaching is a cyclical process of reasoning and acting. In this theoretical model, Shulman categorizes pedagogical reasoning and action into six stages: comprehension, transformation, instruction, evaluation, reflection, and new comprehension (Shulman, 1987). The researcher employed this model as the theoretical framework to anchor this study and considered each stage vital for facilitating the understanding of mathematical word problems through storytelling.

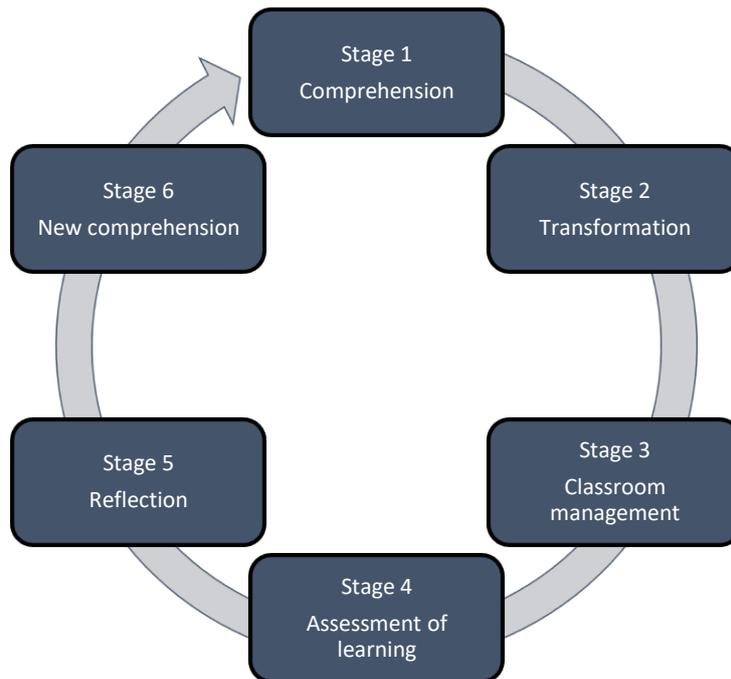


Figure 1: Cyclical process of reasoning and acting

(Source: The author created the graphics while the stages are Shulman's)

Shulman (1987) asserted that stage one, namely comprehension, requires an understanding of the subject content and the purposes for teaching it. The implication of this stage in Shulman's (1987) cyclical reasoning process and acting when linked with the National Research Council and Mathematics Learning Study Committee (2001) is that teachers are expected to understand mathematical concepts, operations and relations. Furthermore, teachers must be accurate, flexible, appropriate, and competent in teaching and learning. Teachers should be able to formulate, represent, and solve mathematical problems in addition to displaying capacity in logical ideas, reflection, explanation, and justification of subject matter. Inclusive in Stage One is for teachers to view mathematics as sensible, useful, and worthwhile.

In stage two, transformation, learning is transformed by teachers consulting with appropriate learning materials, designing appropriate instructional strategies, and adapting learning to learners' individual characteristics and those of the particular group being taught. The transformation of learning entails applying various pedagogies that make the learning environment lively, active, and inviting to create a conducive learning atmosphere (Shulman, 1987). Teachers are pivotal in transforming any learning process, and choosing an appropriate instructional strategy is vital to positive learning outcomes; the transformation of learning is often evident in learners' responses to any learning engagement (Shulman, 1987). Teachers are expected to set clear learning objectives for their expected learning outcomes of word problems, and show how they intend to achieve their lesson objectives through a lesson plan (Stará & Starý, 2019).

Instruction (stage three) relates to proper classroom management; making explanations explicit through demonstrations, metaphors, analogies, examples, and illustrations, among others; creating and conducting interactive classroom sessions; and applying positive reinforcement and constructive criticism. Because mathematical learning is hierarchical, mathematics word problems must be taught successively, that is, teaching from simple to complex, concrete to abstract, and specific to generic, with learning adapted to the needs of individual learners or groups of learners (Mukhamedov, Khodjamkulov, & Shofkorov 2020). In addition, academic strategies in classroom management include behavioral and relationship management. Considering the research of Sun (2015), learners' behaviors need to be appropriately controlled; hence, applying behavior modification and knowledge becomes inevitable in classroom management. Teachers' relationships with their learners undoubtedly play a crucial role in classroom management. Evertson and Weinstein (2006) argue that sustaining an orderly academic environment demands enhancing students' moral and social perspectives.

The evaluation (stage four) focuses on the assessment of learning. Learners' understanding of what has been taught must be evaluated to ascertain whether they understood or did not understand the subject's content. Assessing learning is a process that ensures that learning is progressively monitored, measured, and improved with the sole aim of achieving the objective of learning (Yambi, 2018). On the other hand, evaluation seeks to authenticate and judge the quality level of the outcome of learning performance (Baehr, 2005). Learners' evaluation of mathematics word problems can be progressively conducted in ongoing assessments (formative)

or at the end of the learning process (summative). These evaluations will assist teachers in reflecting on their teaching to enable them to make the necessary improvements.

Reflection (stage five) is essential because it allows teachers to assess themselves. Considering reflection as a process in which teachers explore and self-critique themselves, Tripp and Rich (2012a) allude that the impact of reflection is seen in teachers' pedagogical decisions, which are ultimately aimed at improving their teaching practice. Furthermore, scholars have argued that teachers' reflection-on-action approach retrospectively explains the relationship between theory and professional practice (Tripp & Rich, 2012a). Nevertheless, through reflection, teachers take note of their instructional strengths and weaknesses to improve or adapt strategies to strengthen teaching and learning. During reflection, the teacher analyses and documents what has been reflected upon, leading to the next stage of new comprehension.

In the new comprehension stage (stage six), teachers should have synthesized a new approach to teaching after absorbing an understanding of the strategies identified in stage five.

Storytelling as a pedagogy in mathematics and its effectiveness

Due to the rapid rate of technological development in recent times, there have been modern pedagogical strategies that intertwine technologies and make learning fun and easy. This description fits well with the term pedagogical technology. Hence, pedagogical technology is viewed as the technologicalization of the learning process in education (Shirinov, 2021). Undeniably, pedagogical technology facilitates easy retention, enhances learners' memory, saves time, and sustains learners' interests. However, in some countries in the sub-Saharan region, such as the suburban areas of Nigeria, where pedagogical technology is not yet available, teachers grapple with available resources characterized by local content. One such learning resource is storytelling. Unfortunately, whereas storytelling seems to be conveniently used in teaching subjects that are non-numerically related, such as grammar and reading comprehension (Ekine, 2013), teaching mathematics using storytelling as a pedagogy is far-fetched in Nigerian classrooms. For this reason, literature on storytelling pedagogy in mathematics is scarce in Nigerian primary schools.

In this research, the term 'storytelling' refers in a narrow sense to oral storytelling and in a broader sense to techniques used in other media to unfold or disclose the narrative of a story (Bilen, Hoştut, & Büyükcengiz, 2019; Syafryadin & Salsniwati, 2019). Storytelling encompasses the social and cultural activities of sharing stories, sometimes with improvisation, theatrics, or embellishment (Albool, 2010). Such cultural narratives can be shared for entertainment, education, cultural preservation, and instilling moral values (Jones, & Walton, 2018). Crucial elements of stories and storytelling include plots, characters, and narrative perspectives (Jones & Walton, 2018). This study considers storytelling as a pedagogical approach, whereas word problems are mathematical content knowledge. Teachers are therefore expected to comprehend learning content and appropriately apply storytelling to facilitate learning content.

Ghaderi, Yarahmadi, and Ghavami (2017) examined the effectiveness of storytelling in improving the memory of young learners with reading disabilities in Marivan City, Iran. They found that storytelling significantly improved the memory of young learners with dyslexia. Many educators have shown interest in utilizing stories to transmit mathematical concepts (Niemi & Niu, 2021; Zazkis & Liljedahl, 2019). One of the characteristics of young learners is their use of imagination to create mental images, and hence, the use of storytelling (Cumming & Eaves, 2018; Steiner, 1997). Storytelling appeals to young learners' imaginations and emotions, and helps make learning more meaningful (Cekaite & Björk-Willén, 2018; Sunderland, 2017). When young learners listen to stories, they create mental images that connect the content to something that is personally significant (Cekaite & Björk-Willén, 2018; Egan, 2005; Sunderland, 2017). Thus, storytelling as a teaching technique can be a powerful tool that can bring rich, vibrant, meaningful, and lasting images to young learners.

Furthermore, stories are a unique and powerful way to connect people. According to Kurtz and Ketcham (1994:17): "Of all the devices available to us, stories are the surest way of touching the human spirit." In teaching through storytelling, there is a coming together, a removal of barriers to learning abstract concepts through speaking, and a concentration on and absorption of spoken words. However, good stories do more than create a sense of connection. They build familiarity and trust, and allow the listener to enter the story as they are. Thus, storytelling is ideal for facilitating learning, as it makes learners more open to learning (Jones & Walton, 2018). Moreover, stories are more engaging than dry recitation of data or discussion of abstract mathematical ideas (Cekaite and Björk-Willén, 2018; Sunderland, 2017).

Among the numerous benefits of storytelling in teaching and learning is its unalloyed capacity to encourage, engage, capture and sustain learners' interest for a long time; Storytelling converts everyday experiences to learning opportunities if harnessed adequately by teachers (Moon, 2010). When intentionally and appropriately used, storytelling breaks complex learning content into its simplest form, making sense of the content (Kallet, 2014; McDrury, & Alterio, 2002). In addition to developing critical thinking skills, storytelling develops learners' sense of reflection as they think through the story told in connection with their learning content (Kallet, 2014; McDrury, & Alterio, 2002). Learners gain insight and a vivid understanding of a concept when true stories are shared; hence, the Society for Storytelling (2017-18) assert that when parents tell the true story of

their family to their children, a greater insight into their family ensues. The implication of the assertion by the Society of Storytelling (2017-18) is that storytelling builds emotional bonds with the storyteller; hence, teachers as storytellers are at an advantage in creating closer relationships with their learners, as they use storytelling techniques to facilitate mathematics (Sunderland, 2017).

Most teachers in Nigeria “are used to the chalk and talk method of teaching. In their view, this method allows them to cover their curriculum faster as they are totally in charge of the teaching and learning process” (Author, 2020:92). However, teachers who facilitate learning using the chalk-and-talk method make learners more passive (Author, 2020). Although there is no optimal teaching method, most scholars advocate active teaching and learning strategies in which learners are in charge of their learning. This is one of the core arguments for using storytelling to teach word problems to young learners.

Aim of the study

This study aimed to determine whether using the pedagogical storytelling technique to teach young learners how to solve mathematics word problems improved learners’ performance.

Research questions

The following research questions guided the study:

1. What are the mean scores of young learners who learned word problems in mathematics via storytelling and the conventional chalk-and-talk teaching method?
2. What are the mean scores of young male and female learners who have learned word problems in mathematics via storytelling?

Hypotheses

The following hypotheses for the study were tested at 0.05 level of significance:

1. There was no statistically significant difference in the mean achievement scores of young learners who learned word problems in mathematics via storytelling and the conventional chalk-and-talk teaching method.
2. There was no statistically significant difference between the mean achievement scores of male and female learners who learned word problems in mathematics through storytelling.

Method

The quantitative research method was adopted for the study, while the research design was quasi-experimental with a pretest-posttest design with a control group. The researcher capacitated the four teachers using storytelling teaching methods. Three sessions of one-hour workshops were held for teachers to use storytelling to facilitate the solving of word problems in mathematics. These sessions were conducted over a five-week period.

The study sample consisted of 120 primary two learners, 60 in each group, who were purposefully selected. ANCOVA was chosen as the statistical analysis tool because of the nature of the study design, that is, quasi-experimental (specifically non-equivalent control-group design). This is because the design permits the use of a pretest, which acts as a covariate; therefore, ANCOVA helps establish the homogeneity or equivalence of the two groups before treatment. In addition, since intact classes were used for the study, ANCOVA also helps increase the power of the test because of errors that may occur due to the non-randomization of the subject of the study (i.e., Type I error was reduced).

The study was conducted in a private school in the Owerri West local government area of Imo State, Nigeria. The school was purposively sampled due to parents’ complaints about their wards’ poor performance in mathematics. The participants were young learners in primary 2 classes, with an average age of seven years. The control group was taught word problems of adding up to 100 words using the traditional chalk-and-talk method. In contrast, the experimental group learned the same concepts through the storytelling strategy developed by the researcher. The experiment lasted five weeks.

Learners in the experimental and control groups were assessed on their responses to 20 test questions (formative assessment), with each mark multiplied by 2 = (40%), and 30 examination questions (summative assessment), with each mark multiplied by 2 = (60%). A sample of the word problem given to the experimental and control groups is as follows:

There was a coronation ceremony for the queen bird at the bird castle situated on the peak of a high mountain. The venue of the coronation ceremony was so secured to avoid intruders such as the turtle from attending, as the ceremony was only meant for every flying bird. However, the greedy turtle went to the feather market to buy a hundred feathers to fly to the coronation ceremony like other birds. The feather market is known for the sales of feathers alone. As you all know, Feathers are used for decorations in palaces, used for adornment of harts, hand fans, and many others. The greedy turtle had enough money to buy feathers because he was rich. However, at that time, feathers were scarce in the market because every bird had planned to attend the queen bird ceremony,

so the need for feathers to fly made feathers a scarce commodity in the market. However, the greedy turtle could only buy fifteen feathers from the market. The greedy turtle had five friends among the birds, so he approached them privately to sell some feathers to him. His favourite friend sold thirty pieces of feathers to him, and his second friend enquired to know what he intended to do with the feathers; when the greedy turtle told him, he refused to sell a feather to him. His third friend sold twenty-two feathers to him and gave him an extra ten free in his goodwill. At that time, his fourth had already gone for the preparation of the coronation ceremony, so he was not reachable, whilst the fifth friend sold twenty-eight feathers to him.

- (a) How many feathers do you think greedy turtle now has?
- (b) How many feathers do you think greedy turtle needs to fly and attend the queen bird coronation ceremony?
- (c) If the greedy turtle only has feathers that his favourite friend gave him, how many feathers would he need to enable him to attend the coronation ceremony?

The control group, which was taught word problems of adding up to 100 using the traditional chalk-and-talk method, was asked to solve the word problem below.

A turtle went to the market and bought twenty-seven feathers for an upcoming event. The turtle further bought thirty-one feathers from a nearby shop, and a friend gave him twelve more feathers. He, however, needs a hundred feathers.

- (a) How many feathers do the turtle need to buy to make his feathers a total of a hundred?
- (b) If the turtle could only buy thirty-one feathers, how many more feathers would he need?
- (c) Should all the feathers the turtle has be the ones he bought from the market and the ones given to him by his friend, how many feathers more would he need?

The collected data were analyzed using SPSS version 20.0, using two descriptive statistics (mean and standard deviation) and inferential statistics (ANCOVA). The Faculty of Education, University of Johannesburg's Research Ethics Committee, approved this study. The school principal, teachers, and learner participants provided their consent and assent to participate in the research. They were informed that they were at liberty to discontinue the research without giving any reason for their decision, and that their information would remain private.

Data analysis and results

Table 1: Descriptive mean and standard deviation for research questions one and two

Method	Gender	Mean	Std. Deviation	N
Experimental	Male	60.61	12.252	31
	Female	59.34	8.457	29
	Total	60.00	10.520	60
Control	Male	47.21	7.494	39
	Female	42.86	7.425	21
	Total	45.68	7.697	60
Total	Male	53.14	11.883	70
	Female	52.42	11.443	50
	Total	52.84	11.658	120

Table 1 presents the statistics for research question one and research question two. Responding to Research Question 1, Table 1 shows that learners who were taught mathematics using storytelling had a mean achievement score of 60.0 (out of a possible 100), with a standard deviation of 10.520. In contrast, those taught with the conventional chalk-and-talk teaching method had a mean score of 45.7, while the standard deviation was 7.697. This resulted in a mean difference of 14.3 in favour of the experimental group. In response to Research Question 2, the results in Table 1 reveal that male learners in the experimental group ($M = 60.6$, $SD = 12.252$) achieved slightly better results than their female counterparts ($M = 59.3$, $SD = 8.457$).

Table 2: Inferential statistics (ANCOVA) for the hypotheses at 0.05 level of significance

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8666.250 ^a	4	2166.563	33.186	.000	.536
Intercept	8395.490	1	8395.490	128.598	.000	.528
Pre-test	2235.096	1	2235.096	34.236	.000	.229
Method	5496.489	1	5496.489	84.193	.000	.423
Gender	729.708	1	729.708	11.177	.001	.089
Method * Gender	4.886	1	4.886	.075	.785	.001
Error	7507.741	115	65.285			
Total	351243.000	120				
Corrected Total	16173.992	119				

From the ANCOVA shown in Table 2, the statement of Hypothesis 1 is rejected, implying that there is a statistically significant difference in the mean achievement scores of learners who learned mathematics via storytelling and those who learned via the conventional chalk-and-talk method of teaching ($F_{1, 115} = 84.193$, $p < 0.05$). The results also revealed a statistically significant difference between the mean achievement scores of male and female learners who learned mathematics using storytelling ($F = 11.177$, $\text{Sig.} = .001$; $p < 0.05$). Moreover, the results further show that the use of the storytelling technique accounted for approximately 42.3% of the variance observed in learners' mathematics achievement.

DISCUSSION OF FINDINGS

This study revealed that the mean achievement score of learners who learned via storytelling to solve mathematics word problems was significantly higher than those taught using the conventional chalk-and-talk teaching method. This result confirms the assertion of Bates and Wiest (2004), who noted that adopting a storytelling approach enables learners to solve complex numeric equations. This result further strengthens the claims of Egan (2005) and Forest (2007), who mentioned that storytelling effectively develops learners' sense of imagination and is fully involved in the learning process. Additionally, the results showed that the storytelling technique accounted for approximately 42.3% of the variance observed in learners' mathematics achievement. This implies that learners' actions regarding the use of storytelling are positive in terms of Shulman's theoretical model of pedagogical reasoning (Shulman, 1987). It further confirms the research of Ghaderi, Yarahmadi, and Ghavami (2017) when they noted that storytelling effectively improves the memory of young learners. Apparently, other studies support these findings in that when young learners learn through stories, they create mental images that connect the content to something personally significant (Cumming & Eaves, 2018; Steiner, 1997; Society for Storytelling, 2017-18). The experimental group's higher achievement could thus be attributable to storytelling appealing to young learners' imaginations and emotions, which helps make learning more meaningful, and to stories being more engaging than a recitation of data points or a discussion of abstract ideas (Cekaite and Björk-Willén, 2018; Sunderland, 2017). Although the study was conducted in a private primary school, there should be no difference if the same procedure is applied to a public primary school.

Recommendations

Storytelling as a pedagogical technique should be employed in primary schools to enhance the mathematics achievement of young learners. Government and private school proprietors should train in-service school teachers using storytelling pedagogic techniques to benefit young learners in mathematics. The researcher recommends that teachers who have learned to facilitate mathematical word problems using storytelling in the experimental group should reteach control group learners who were not taught using storytelling pedagogy.

CONCLUSION

This research determined how storytelling as a pedagogy enhances young learners' performance in mathematics word problems compared to traditional chalk-and-talk teaching methods. A private primary school known for its poor performance in mathematics was used as a case study. The study adopted a quasi-experiment research design to teach learners in the experimental group word problems in mathematics using storytelling. These learners were taught how to intentionally facilitate word problems using storytelling as a pedagogy. The results showed that storytelling is very effective in teaching word problems in primary schools. The implication of this result for the Nigerian primary school system is that private and public primary school teachers could adopt

storytelling pedagogy to facilitate mathematics learning when word problems are employed. Although the research focused on using storytelling in primary schools, the researcher suggests that research be conducted on the use of storytelling in other mathematics content to determine the effectiveness of its use.

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