A STUDY ON THE CAUSES OF LEARNERS' ACADEMIC PERFORMANCE ON TOPIC TIME IN GAMODUBU PRIMARY SCHOOL

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Abstract

The study aimed at finding out the causes and effects of learners' academic performance on topic time in Mathematics. The study also sought to establish the strategies that can be used to improve academic performance on the topic, as the topic was performed at an average of 39.2 % ABC from 2016 to 2018. The purpose of the study was to find out if factors relating to learner efforts; support by parents and support by the school contribute to low academic performance on the topic time. The objectives of the study were to determine the extent at which home, learner and school factors contribute to academic performance of topic time in Mathematics and strategies which could be used to improve topic time on academic performance. The study used mixed method approach and explanatory research design. Purposive sampling technique was used for the selection of the sample of 50 learners, 10 teachers and 10 parents. The instruments for data collection were questionnaires and individual interviews. Data collected were analyzed using simple mean and percentages. The findings show that factors such as lack of commitment; lack of time and poor methods of teaching contribute to poor academic performance on question time. Some of the interventions suggested include having special training on teaching the topic time; establishing the Mathematics club and having Mathematics quiz competitions.

Key words: *question time, academic performance, school factors, home factors, learners' factors*

Introduction

Many learners around the world are trapped on low academic performance in Mathematics especially on geometry and measurement topics including time (Organization for Economic Cooperation and Development (OECD), 2015 & Kapur 2018). According to OECD (2014), this low academic performance in Mathematics has long term consequences, both for the individuals and the nation at large because it is a requirement for most of the careers and is entailed in almost all the subjects. This is supported by Kapur (2018) who posits that when a great number of learners fail Mathematics at school, the country's long term economic growth is severely compromised. Hence this study investigated the causes and effects of learners' performance on topic time. Learners performance on topic time was investigated because topic time carried about 40% of the content in Botswana Mathematics syllabus and 20% in other subjects hence its performance had an effect on other subjects (Botswana Curriculum, 2005). Therefore more efforts must be made to improve learner academic performance in Mathematics especially on topic time because developing countries have little or no empirical studies on it.

However, there are some studies conducted in developed countries on improving Mathematics in developed countries. Programs for International Learner Assessment of Science (PISA) conducted a research in 2012 which showed that 3 million of 15 years old learners in 64 countries and economies perform badly in reading, Mathematics and Science subjects. Though a huge numbers of countries performed badly in Mathematics, Science and reading, Brazil, German, Italy, Mexico, Poland, Portugal, the Russian Federation, Tunisia and Turkey showed an improvement in Mathematics between 2003 and 2012. This is a lesson to all countries that academic performance of Mathematics can improve, if the right policies and practices are given and implemented. Hence the study was conducted to improve academic performance of topic time in Mathematics**.**

Background

This study was conducted in Botswana in Gamodubu Primary School. The school is located in Kweneng region about 30 km from Molepolole to Gaborone road. The school enrolled 421 learners within Gamodubu and some from the lands, settlements and cattle post in the nearby areas. Most of the parents work in the Capital City of Botswana Gaborone which is about 30 kilometres from the village. Therefore their parents wake up early to go to work and come back late which makes it difficult for them to help their children with school work. This is one of the factors which makes the school to be an average performer with an average performance of 53.2 % on overall performance from 2016 to 2018. This low academic performance was also evident in other subjects like Mathematics which had an average performance of 45.2% ABC from 2016 to 2018.

When interrogating results by topics; time, numbers and numeration, variations, graphs, money, algebra, area and volume, topic time was the lowest in Mathematics from standard one to standard seven, it had an average performance of 39.2% ABC on third term examinations from 2016 to 2018 (Botswana Curriculum, 2005). This was believed to have contributed to poor academic performance of Mathematics in general, as topic time took about 40% of items in monthly tests and end of term tests. Time also was applicable in all primary subjects in Botswana, which are English, Setswana, Social Studies, Science, Religious and Moral Education and Agriculture hence it led to poor academic performance of them (Botswana Curriculum, 2005). Hence the study wanted to investigate the causes and effects of academic performance on topic time because there is no study in Botswana on the topic.

Statement of the problem

Time is inevitably utilized in many daily life activities. Yet it is still among the most poorly performed topic in Mathematics in Gamodubu Primary school. This topic was performed at 39.2% ABC passes in Mathematics average from 2016 to 2018. This contributed to poor academic performance of Mathematics in general which was performed at 45.2 % ABC and it took about 40% of items in monthly tests and end of term tests. Topic time was found in all primary subjects in Botswana and was performed in average passes of ABC from 2016 to 2018 as follows; Social studies-40.5%, Science-42.9%, Setswana-44.5%, English-42.1%, Religious and Moral education-46% and Creative and performing Arts-43.7%. Topic time took about 20% of the items hence it led to poor academic performance of such subjects. Therefore the study sought to investigate the causes and effects of topic time on academic performance and to establish the strategies that can be adopted to improve academic performance in Gamodubu Primary School. The study determined the learners' factors, school factors and home factors that affected performance of the topic and establish strategies that can be adopted to improve performance on the topic.

Purpose of the study

The study wanted to find out causes and effects of topic time on academic performance of learners in Gamodubu primary school. The study determined the learners' factors entailing learner effort on the topic, school factors entailing support given by the school on the topic and home factors entailing on the support given at home on the topic and establish strategies that can be adopted from literature and the findings to improve performance on the topic. The study wanted to investigate the causes and effects of the topic time on academic performance by answering the below research questions.

Research questions

1. Which home factors contribute to low academic performance on the topic time?
2. Which school factors contribute to low academic on the topic time?
3. Which learners' factors contribute to low academic on the topic time?
4. What are the strategies which can be used to improve academic performance on topic time?

Significance of the study

It was envisioned that the findings of this study will benefit the following people either individually or collectively

Learners: findings of this study may give the learners insights on possible factors that could affect topic time performance which can be used as a turnaround strategy to improve overall performance on the topic.

Mathematics teachers: results of the study may allow the teachers gain a wider perspective with regards to learners' Mathematics topic time performance which in turn can be used to improve their way of teaching for enhancement of the teaching-learning process. They may be in a better position to decide on what possible intervention programs can be designed and implemented to address the problem.

Researchers: The result of this study may hopefully generate interest, new and interesting ideas and eventually serve as basis for other researchers to pursue similar and perhaps even more comprehensive studies in the future.

Literature Review

There are some empirical studies on academic performance of topic time in developed countries. International Study on Mathematics INTO (1990) on Mathematics in Primary Schools conducted a research on topics of Mathematics. The study indicated that time ranked number four among the subjects which were mostly failed, the first being measurement, algebra, and decimals. Learners indicated the causes were that, the topics posed more challenges working with hence they needed assistance in such topics. They also indicated that the topics should be practical with the totals easily verified by measuring.

Ireland also took part in a number of international surveys on Mathematics achievement since 1971. The surveys targeted the nine year olds and 13 year olds primary going children. It was called the International Assessment of Educational Progress IAEP. The surveys covered six content areas which were; Numbers and Operations; Algebra; Relation and Functions; Geometry; Measurement; Data Organisation and Interpretation and Logic and problem solving. The IAEP (1988) carried out to tests in five countries; Ireland, United Kingdom, United States of America, Korea, Spain and seven Canadian provinces in six content areas. Ireland, UK, Spain and French Canadians performed at the mean level, English Canadians performed above the mean, Korea achieved well above the mean. The USA performed below the mean. Ireland scored particularly badly in Data Organisation and Interpretation and relatively badly in Geometry and Measurement. The study found that the causes of low academic performance on the above topics were that they were not taught from an early age and children were not given a chance to handle materials, investigate them and then discuss and compare their findings.

IAEP (1996) also tested 20 countries. Ireland scored significantly below the mean in both geometry and measurement. TIMSS (1995) included 45 countries Ireland scored over a mean score in six content topics. In Programme for International Learner Assessment PISA (2000) Ireland scored above average. Items relating to number and data have been the most successful, while those relating to geometry, measurement and algebra have been less. The causes of low academic performance on geometry, measurement and algebra were; learners' attitude to Mathematics and socio-economic backgrounds.

Regionally studies on Mathematics did not specifically studied topics of Mathematics but they studied it as a subject and have proved that performance in it has been persistently poor. According to Sundai and Sheriff (2015) in their study on factors contributing to poor academic performance in Mathematics at West African Senior School Certification Examination and they have found causes to be under staffing, inadequate teaching and learning, lack of motivation and poor attitudes by both teachers and learners. Improving on these factors and sensitization of the local community to discard practices which prohibit learners' effective participation in learning Mathematics was practised. However, Kaur (2017) in Punjab also investigated on the Math-phobia, causes and remedies in primary schools and indicated that the causes of maths phobia in schools were modern Mathematics, the poor system of examination, lack of effective teaching aids, shortage of qualified Mathematics teachers, poor learner-teacher relationship, nonconductive environment for math class among others and this can be solved by doing maths games, training teachers and practice maths every day.

According to Panthi and Belbas (2017) in their study on teaching and learning issues in Mathematics in the context of Nepal, have found factors contributing to failure of Mathematics as classroom management, ethnicity, lack of trained teachers, inequity, lack of teaching aids and materials, lack of textbooks, lack of time for learners, lack of clear objectives, gender issues and issues of mathematical

contents and pedagogy. They said most of public schools in Nepal do not have proper management of the classrooms, they have inappropriate size of classes, not inclusive seating arrangement, and there is also lack of technology for learning and teaching Mathematics. There is also misuse of technological tools even if it is available.

In Botswana there is no study on Mathematics and also on causes and effects of low academic performance topic time hence the study wanted to close the gap.

Theoretical framework

The study used Cognitive Load Theory of John Sweller of 1988. Cognitive load is defined as the knowledge that is required to be handled by the working memory of learners at a time (Cooper, 1998; Kirschner, Artino & Paas, 2009). Sweller continues to state that the working memory of a learner can only process and handle a few new elements, for a short period of time (Sweller, 1994; Anthony & Artino, 2000; Merrienboer & Sweller, 2005 & Kirschner et.al, 2009). Therefore successful learning occurs when a learner's working memory is able to process new information and store them in schemas so that more space can be made available for new information (Anthony & Artino, 2008).

Schemas are cognitive processes of organizing basic knowledge to already existing knowledge (Sweller, 1994). Schemas reduce the load of the working memory because they organize information into elements, which make it easier to remember (Sweller, 1994: Cooper, 1998). Schemas occur in two ways, firstly, unconsciously, which is called 'automated processing' and secondly, consciously, which is called 'controlled processing' (Sweller, 1994). Cooper (1998) posits that learners understand better when they have the basic knowledge of the content they are taught. Therefore this suggests that a learner with a high level of knowledge in a subject will only require a few elements to store information because most elements have already been attended to. This is different to a learner with a low level of knowledge because he or she will be seeing information for the first time, and will need a working memory to attend to many elements (Cooper, 1998).

Merrienboer & Sweller, (2005) suggest that the reduction of the cognitive load of a learner can be used in subjects like Science and Mathematics. The cognitive load have three types of cognitive loads namely; Intrinsic cognitive load, this type of load is determined by what a learner knows (expertise), the extraneous cognitive theory load, is determined by how tasks are presented to the learners and the Germane cognitive load is determined by the construction of the schema and rule automation (Anthony & Artino, 2008; Kirschner et.al, 2009).

The theory has identified several instructional ways to reduce the extraneous cognitive load so that the intrinsic and Germane cognitive load increase (Kirschner et al, 2009). There are goal free, worked examples, split attention and modality and redundancy effect (Cooper, 1998; Merrienboer & Sweller, 2005; Anthony & Artino, 2008; Kirschner et al, 2009). With goal free effect; the theory believe that learners are given goal-specific problems they focus on the goal and do not take into consideration other information (Cooper, 1998; Merrienboer & Sweller, 2005; Anthony & Artino, 2008; Kirschner et al, 2009). The Spit attention gives the learners different teaching and learning materials to split the attention of the learner e.g diagrams with text that explain them, because no diagram is self-explanatory (Cooper, 1998; Merrienboer & Sweller, 2005; Anthony & Artino, 2008; Kirschner et al, 2009).

The modality effect is whereby instruction is done in two teaching and learning modes simultaneously e.g by using auditory and visual instruction (Cooper, 1998; Merrienboer & Sweller, 2005; Anthony & Artino, 2008; Kirschner et al, 2009). The redundancy effect is where the information is presented more than once (Cooper, 1998; Merrienboer & Sweller, 2005; Anthony & Artino, 2008; Kirschner et al, 2009). Worked examples; improves the comprehension of the learners and indicates to the learners the procedure they should follow to solve problems (Cooper, 1998; Merrienboer & Sweller, 2005; Anthony & Artino, 2008; Kirschner et al, 2009). This effect arises because, as the learners are exposed to worked examples and their solutions, it allows them identify types of problems to recall the steps relevant to each type of problem, and to solve each problem without mistakes (Cooper, 1998; Merrienboer & Sweller, 2005; Anthony & Artino, 2008; Kirschner et al, 2009).

Methodology

In this study, a mixed method approach was used. An explanatory research design was used, that is where by the questionnaires were administered and interviews were used as a follow up (Creswell, 2009). In this study the researcher collected quantitative data using questionnaires and qualitative data by means of interviews (Creswell, 2003; McMillan & Schumacher, 2010). This approach was seen as ideal, because the aim was to capture in depth views of Mathematics teachers, learners and parents. Such views were able to put into perspective, the context in which the teaching and learning of topic time took place. Also the views provided an empirical basis of what could be done to counter the contributory factors to poor academic performance in topic time (Creswell, 2003).

Both primary and secondary data were used in this research. Secondary data were obtained from books, articles, test marks, internet sources to review literature. Primary data were collected through questionnaires survey and face to face interviews (Denzin & Lincoln, 2005).

According to Berg (2009), interviews are used to get the story behind a participants experience and to get in-depth information about the topic. Burns (2000) agrees with this by stating that a lot of relevant about people's experiences are collected by directly questioning or talking to them. Only a small number of individuals were interviewed about the same topic so as to get more viewpoints about the questions that needed further explanation. The interviews were conducted simultaneously with the issuing of the questionnaires. The researcher conducted interviews with teachers, learners and parents.

The targeted populations for the study were 50 learners, ten teachers and ten parents. Only one school was used. The data collection instruments were organized and pilot tested on eight participants; two teachers, two parents and four learners to obtain the reliability and validity. The school calendar was reviewed to identify the most appropriate date and time of participants and the study took place immediately after examination. Participants were reached through randomly visits to classes after school (Creswell, 2003). The purpose of the study was explained to all staff, learners and parents. All learners, teachers and parents volunteered to participate in the study. Printed survey instruments were distributed and explained to the participants before they could answer. The participants completed and returned the survey. Purposive sampling technique was used where participants with rich information on the topic were selected (Creswell, 2009). The quantitative data from questionnaires were analyzed. Data were processed into statistical tables for interpretation and discussion. Processed data were analyzed both quantitatively and qualitatively.

Collected instruments were reviewed for any data entry or error. No missing data or error was detected (Creswell, 2003).

Results Analysis and discussion

Home factors contributing to low academic performance

Table 1.How you feel about topic time in Mathematics

Respondents who agreed	Parents (10)	%
Almost everyone can learn topic time if it is properly taught	8	80
You can get along perfectly well everyday life without the topic time	4	40
I feel a sense of insecurity when dealing with topic time	6	60

About 80% of the parents showed that they know about topic time. Parents further indicated that long before the coming of Europeans in Botswana, Batswana were not using clocks for time. They predicted time using plants, seasons and events that happened during those days. Furthermore they indicated that though there are still few elderly people who indicated time by such, most of the people nowadays use adverbs of time to indicate time. About 40 % indicated that someone can get along well without topic time. Henceforth, they indicated that most of the people are not incorporating the academic concepts of time into their homes on a daily basis hence making it an abstract concept for the learners to work with at school. Moreover about 60% of parents showed that they feel in secured when dealing with topic time. They said this was so, because the classroom instructions were conducted in a manner which is not responsive to the children home culture. This is supported by UNESCO (2008) when arguing that failure of Mathematics is caused mainly by cultural issues in teaching and learning Mathematics. They continue to say that learners leave their own family culture outside the school and enter the school that is different from their home culture. However, Panthi and Belbase (2017) also support this by saying "The Mathematics curricula designed by experts and implemented by the government to all grade levels do not fit our culture……. We feel its Western Mathematics that we are teaching and learning without considering the needs of learners, diversity and values of our society, and norms of the eastern culture"" (p.2). Furthermore, Cooper (1998) in relation to the theory of cognitive load posits that learners understand better when they have the basic knowledge of the content they are taught. Therefore this suggests that a learner with a high level of knowledge in a subject will only require a few elements to store information because most elements have already been attended to.

Learners' factors contributing to low academic performance

Table 2 How I feel about topic time

Respondents who agreed	Pupils (50)	%
Topic time is my best topic in Mathematics	35	70
I find topic time confusing	48	96
Topic time is fun and exciting	25	50
Topic time is helpful because it helps in the study of other topics in other subjects	26	52
I feel a sense of insecurity when dealing with topic time	48	96

In general topic time was highly regarded by learners in Gamodubu Primary School, because 70% of the learners indicated that topic time is the best topic for them. Henceforth about 50% indicated that it was interesting and took it as a favorite topic. Though 50% showed that they had interest on the topic, about 96 % of the learners found topic time to be abstract and did not have confidence in learning it. When asked about the effort they put in understanding topic time, they indicated that when they have difficulties working problems of time, they discuss with their classmates, and only a minority indicated that they consulted their teachers. As found in many other, studies, hardworking was perceived as the most important factor contributing to success in Mathematics (Kapur, 2018). This is supported by Sweller (**1988)** in the theory of cognitive load which states that learner cognition influences learner motivation which, in turn, influences performance (Anthony & Artino, 2008). In this study learner cognition and learner motivation are regarded as a key element towards the learner's academic performance since they determine the success of learning. Hence more should be done by both teachers and parents to motivate learners on the topic.

Table 3 Mathematical activities

Frequency at which activities are done	Often	Not often
Integration with other subjects	39	11
Mental Mathematics	37	13
Memorization of facts and formulae	36	14
Estimation	32	18
Talk and discussion	47	13
Use of the environment	31	19
Drills	35	15
Recitation	35	15

Learners were asked how often they used the mathematical activities. The learners indicated that they used integration with other subjects, mental Mathematics, memorization of facts and formulae and talk and discussion as shown by the table above. Estimation and use of the environment activity were not much

used. In an interview, learners stated that for someone to be successful on the topic time, he or she must have a good teacher and must study at home. Learners also indicated that memorisation of facts and formula was important but not necessary because topic time requires working out problems in most cases. They were quite positive about the value and importance of use of the environment, talk and discussion and integration of the topic in other subjects since topic time is required for everyday life and is entailed in other subjects. In discussing their experience of learning the topic learners said they generally preferred to ask their parents or siblings for help at home, or alternatively to ask one of their friends. Learners showed that they felt frightened when questioned in class and also felt under pressure to get the answer right. Moreover, the learners indicated that teachers used lower-level and drill questioning with the emphasis on giving the right answers. All in all it shows that, activities used by teachers when teaching learning topic time were not benefiting the learners and were in contrary with what cognitive Load theory suggests because it suggests that the schemas should be properly constructed for the learner to master the subject. The findings show that teachers were not able to work out the learners' schema acquisitions and the transfer of learnt procedure which are from controlled to automatic processing (Sweller, 1988).

School factors contributing to failure of topic time

Table 4: Methods of teaching time, learning and assisting learners to learn time

Teaching method	Number of participants	%
Lecture method	2	20
Collaborative learning method	5	50
Project method	5	50
Problem solving method	6	60

The data indicated that 20 % of teachers use lecture method, 50% use collaborative learning, 50% use project method and 50 % use project method. Generally, in this study traditional pedagogy such as lecture method and transmission approach has proved to be used. Belbase, (2014) argues that, the kind of pedagogy is not good for learners because it might create social injustice since learners may not have an opportunity to learn at their pace and learn through interaction and negotiation. Belbase continues to say that it may be unfair for some learners since they will not be given some opportunity to reflect on what they learnt. Despite the Mathematics curriculum that suggests learner-centred and joyful learning, teachers were seems to be adopting a traditional chalk-and talk approach (Botswana, curriculum, 2005). Teachers also indicated that huge class size and boring classes hampered learning too. This was supported by Cooper (1988) who argues that the reduction of a learner's cognitive load relies on how these mathematics subjects are taught or how the teaching and learning materials has being designed.

Table 5 Availability of resources for teaching time

Available resources as said by respondents	Teachers (10)	%
Resource books	2	20
Text books	0	0
Watches	2	20
Calendars	6	60
Time tables	4	40
Seasonal charts	2	20

Findings showed that there were few resources used for the topic, as it showed that out of ten teachers only two had resource books, two had watches, and six had calendars, four had time tables, two had seasonal charts and teachers had no text books. The other challenge of time outlined by teachers, was of the new digital world. They said the digital world has introduced digital times used in clocks, cell phones, computers hence learners have less exposure to analog clocks. They indicated that the analog clock is the best for teaching time in primary Mathematics because it gives the learners clue on how hours and minutes are divided. This is supported by OECD (2000) which say Mathematics education is part of life skill to develop creative and critical thinking and problem solving in day-to day life. Moreover, Kaur (2017) states that difficult formulae in the textbook, not able to use the library, tough examples which are not explained in one or two different ways, lack of library books, number of practice which are less, heavy syllabus, more theoretical and less practical are the cause of failure in Mathematics. The same thing was also a problem in the study and in addition no instructional materials, other than blackboard, chalk and learners were used in the study to teach topic time.

Strategies that can be used to enhance the teaching of topic time

Strategies were given by participants. Teacher participants suggested that Mathematics teachers could be provided with special training on teaching the topic time. The other teacher suggested that the school can establish the Mathematics club, have Mathematics quiz competition and have Mathematics Olympiad among learners.

Parent participants suggested that learners can be encouraged to love the topic and this can be done by using time instruments at home like clocks, time tables and calendars and by teaching them time using traditional games , like , diketo, morabaraba puzzles like mhele and music like koi which can help them grasp the time concepts easily.

Learner participants suggested that learners must practice concepts of time daily both at school and at home. They must learn from their mistakes they should not fear doing the time problems. They must consult their teachers when they do not understand or when they get stuck. They must always ask their doubts and try to understand what their teachers are teaching carefully. They must use the relevant study materials for studying. They must always be confident about themselves and never give up.

Conclusion

This study investigated the causes of topic time on academic performance in Gamodubu Primary School. The findings are important as they would help primary school Mathematics teachers to understand the causes and effects of topic time on academic performance together with strategies required for good

academic performance on topic time. The findings showed learner factors as; lack of commitment, bad attitudes towards the topic, home factors as; language used at home not incorporating concepts of time, lack of time resources and school factors as poor methods of teaching and lack of time resources. The strategies were suggested by learners, teachers and parents participants includes having special training on teaching the topic time; establishing the Mathematics club and having Mathematics quiz competitions.

Recommendations

From the findings of the study the following recommendations are made;

a. The Government of Botswana should enhance the provision of teaching and learning materials on topic time to schools
b. The Ministry of Basic Education should review the curriculum to make it relevant and flexible to the diverse needs of different regions and backgrounds of the learners

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