Teachers' Lesson Development and students' mathematics performance in public secondary schools, Makindye Division, Kampala, Uganda

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Abstract

The study examined lesson development and students' mathematics performance in public secondary schools in Makindye Division, Kampala, Uganda. The study objectives was establish the relationship between lesson development and student's mathematics performance in public secondary school. The study employed descriptive correlational design. Correlation was used to determine the relationship between lesson development and student's mathematics performance. The researcher used both qualitative and quantitative approaches. This method was good at providing a better understanding of the research problem. The target population was 993 respondents, which included senior four students and 12 mathematics teachers from four selected schools in Makindye Division. Questionnaires, observation checklists and interview guide were used to gather data. Frequency, percentage, means, standard deviations and Pearson Linear correlation coefficient were used to analyze the data. The findings showed that there is an insignificant relationship between lesson development and students' mathematics performance. Based on the findings the conclusion is that lesson development has relationship with students' mathematics performance. In the process of lesson development, it is recommended that mathematics teachers should improve on the way they begin their lessons to attract, excite and stimulate the students more, as well as using appropriate methods to encourage more student's participation.

Keywords: Lesson development, Students' mathematics performance, Public secondary schools,Uganda

Introduction

In considering the educational reforms in Uganda, there have been tremendous dropping of students 'performance especially in mathematics year after year both in public and private secondary schools. Citing an example, in the year 2015, 4800 sat for the examination only 1200 passed, (MEST,2017). In Makindye division, it was reported also that the passers in three consecutive years were 25%, 36% and 38% of students who sat for mathematics Mock examinations in 2015, 2016, and 2017 respectively (MEST, 2017). The purpose of this study is to examine the relationship between teachers' lesson development and students mathematics performance in public secondary schools, Makindye Division, Kampala, Uganda.Lesson development is the proper practicing of learning activities which presents a complete picture. it is a systematic implementation of subject matter. Lesson development is one which involves a series of learning experiences that are linked to achieve the aims composed by methodology and contents (Wong, 2016). Lesson development is a practical organization of various activities, experiences and types of learning around a central problem or purpose developed cooperatively by a group of students under a teacher leadership involving planning, execution of plans and evaluation of results during the class time. (Sugai,2015).

According to Khan ,(2007) in his study compared pedagogical content knowledge of one expert mathematics teacher and that of one trainee teacher at elementary school level in Mainland China. They found that the expert teacher knew students' prior learning experience, knew similar topics related to the teaching topic, and could flexibly use both in practice. However, the trainee teacher did not possess similar qualities. It was also found that the expert teacher knew students' problems and difficulty well and could make relevant preparation before the lesson and implement them in the class on lesson development for these while the trainee teacher could not do so. For effective lesson development the teacher needs to put in mind the capabilities, interest of the learner should be considered, Prepared on the sound psychological knowledge of the learner, Provide a new learning experience; systematic but flexible, sustain the attention of the learner till the end, related to social and physical environment of the learner and development of learner's personality.

The difference between lesson plan and lesson development is that, lesson planning is a thinking process, not the filling in of a lesson plan template. Lesson plan envisaged a blue print, guide map for action, a comprehensive chart of classroom teaching-learning activities, an elastic but systematic approach for the teaching of concepts, skills and attitudes (Wong, 2016). Whereas, lesson development is the implementation of the plan into action during the class time.

Lesson Development

Lesson development is pertaining to preparing and motivating students to the lesson content by linking it to the previous knowledge of the students by arousing their curiosity and by making an appeal to their senses. This prepares the child's mind to receive new knowledge. "To know where the students are and where they should try to be are the two essentials of good teaching." Lessons may be started in the following manner: (a). two or three interesting but relevant questions (b). showing a picture/s, a chart or a model (c). a situation statement of aim: announcement of the focus of the lesson in a clear, concise statement such as "Today, we shall study the..." (Sugai,.2015). In the actual lesson development, the behavior of teacher is essential; this step should involve a good deal of activity on the part of the students. The teacher take the aid of various devices such as questions, illustrations, explanation, expositions, demonstration and sensory aids, etc. Information and knowledge can be given, explained, revealed or suggested. (Wong 2016).

For mathematics, the following principles should be kept in mind: Principle of selection and division: This subject matter should be divided into different sections. The teacher should also decide as to how much he is to tell and how much the pupils are to find out for themselves. Principle of successive sequence: The teacher should ensure that the succeeding as well as preceding knowledge is clear to the students. Principle of absorption and integration: In the end separation of the parts must be followed by their combination to promote understanding of the whole. It is always desirable that new ideas or knowledge be associated to daily life situations by citing suitable examples and by drawing comparisons with the related concepts. This step is important when establishing principles or generalizing definitions. (Wong,2016). This concept is concerned with the systematizing of the knowledge learned. Comparison and contrast lead to generalization. An effort should be made to ensure that students draw the conclusions themselves. It should result in student's own thinking, reflection and experience (Simonsen,2015).

In peer interaction, turn taking and the choice of content is spread amongst the students. (Rommetveit,1985). Prepared tasks of group work usually results in extensive negotiation of meaning. In this respect, it contrasts with the teacher –fronted instruction where typically little interactional modification takes place. Students who have the responsibility for managing their own talk must cope with silences, negotiate how, when and who talks, and assess the relevance and quality of communication (Barnes and Todd 1995). Consequently, lesson development among students is usually complex and dynamic in nature. The extended opportunities for using language and participating in classroom interactions seem to give student simple opportunities for joint meaning-making and knowledge construction. Yet, the dynamic nature of interaction in peer groups also poses new challenges and responsibilities for students engaging in productive classroom communication and learning.

Working collaboratively in groups is reported to help students to construct and increase awareness of their own thinking processes. In other words, students share their views and perspectives with others and can discover divergent ways of solving problems. Moreover, they can build on each other's contributions to re-construct new interpretations and views that were yet to be discovered. The practice of sharing and constructing perspectives in collaborative interaction is also assumed to be more emphasized. (Pressley 2000). Micro-level analyses of the lesson development process inherent in Learning groups have shown that focus on completing the task rather than

engaging in joint reasoning problem solving. In these learning situations, learners are likely to be product oriented, in which individual problem solving may play a bigger role than that of cooperative meaning-making. (Kumpulainen and Mutanen, 1998).

Efforts to improve the lesson must focus on the single most important component: the classroom teacher (Ingwalson and Thompson, 2007). Teachers in middle level schools must be well prepared to face the challenges of working with young adolescents; and critical components of teacher preparation are the knowledge and skills from education and related fields that enable them to develop effective, and often unconventional, management systems in their classrooms. This effort must begin with a new paradigm in which teachers view classroom management as an ongoing exercise in building relationships.

When students question being non-compliant or engaging in disruptive behaviors, they may easily trigger an emotional reaction from the teacher. For example, Sammy, a seventh-grade student, might say, "Why should I listen to you? You're just a middle school teacher. Why don't you have a good job?" The unexamined response that a teacher might give is this: "You have no right speaking to me like this. I know a lot more than you do, and I know you have detention today. See me after school." All that cannot come if the lesson was developed well. (Ellis 2005). Because teachers do have authority and certain privileges afforded to them by their position, anger and frustration often lead to the abuse of power in punitive ways. This usually happens when the adult does not take the opportunity to examine his or her own vulnerabilities on a regular basis. When the disruptive adolescent repeatedly insults or disobeys the teacher, the teacher's ego takes over, demanding respect. (Wong, 2016).

Students do not always engage in arguments, provide explanations and elaborating or hypotheses justifying their actions or views through their verbal interaction. Students may use imprecise language when communicating their views to their peers. All these elements challenge the reciprocity between interaction members that is, apparently, necessary for collaborative meaning-making (Ellis 2005). Learners need to participate in the discourse of the lesson. The involvement can be, among others, in the form of speaking, listening, thinking, be listened to. Actual cognitive conflict occurs more easily when students do not feel the pressure of an authoritative figure. In this case, mathematics teacher, besides, learners cannot get enough practice just by listening to the teacher and very little talking from students. Therefore, lesson development has to inter students' discussion for the free flow of ideas (Howie and Plomp, 2000).

When a teacher is self-aware of vulnerabilities, such as the need for power, he or she is more likely to respond strategically rather than emotionally. For example, a teacher who knows he is sensitive to students questioning his authority can anticipate that middle grades students will, in fact, question his authority. Such awareness can lead to the use of empathy or the admiration of negative behaviors, as previously discussed. In essence, the key to leaving one's ego at the door is a

d outside the homes (Naom, 1998).Experiences from Tanzania show that during the pre-colonial period the purpose of learning Mathematics was to equip members of society with mathematical tools which were necessary for the day to day needs of the indigenous people (Mmari, 1995). Traditional Mathematics was based on four numerations of addition, subtraction, multiplication and division. Modern counting techniques were introduced by the Arabs before the coming of Europeans. They established Koranic schools in the trading centres in which no doubt, basic knowledge of reading the Koran was provided together with elementary mathematical skills (Howie and Plomp, 2000).

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Students Mathematics Performance

Performance is one of the concepts that is used in this study. It is the act or style of performing a work or a role before an audience, or the way in which someone or something function. While, Sichizya (1985) conceptualised performance as the ability of students to demonstrate what they know about the curriculum content, and also what they can do with what they know. Further stated that performance measures what students have learned and how they are able to use what they have learned.

Mathematics as a formal area of teaching and learning was developed about 5,000 years ago by sumerians (Mariki, 2009). Since its inception, mathematics has been a powerful tool for developing the faculty of knowledge and therefore a pre-requisite for many other

disciplines (Mrimi, 2005). Potentials of mathematics have been also reflected through the fact that all sciences require Mathematics; and it is one of the easiest sciences because no one's brain rejects it whether laymen or semi-illiterate they know how to count and record.

National Council of Teachers of Mathematics (NCTM), (1989), acknowledged that mathematics enables people to mediate and to be able to develop a sharp way of thinking as one cannot do mathematics without reasoning; and its techniques provide very scientific and cheap way of analyzing and solving various problems that we face in our day to day living. It enables students to be rational, critical thinkers engaged in logical processes and conjectures in a variety of ways. The subject fits in groups of many subjects for example there is Mathematics in Geography, biology, accounts and economics. Mathematics plays a significant role in science. Just as the language of true literacy not only specifies and expresses thoughts and process of thinking but also creates them in turn so does mathematics not only specify, clarify and make rigorous workable concepts and laws of science, but also at certain crucial instances it becomes an indispensable constituent of their creation and emergence as well (Bochner, 2007). This plainly entails that mathematics is a fulcrum in which other subjects can rotate and find their being (Mariki, 2009).

The problem of low performance of secondary school students in Mathematics is partly the result of where formal Mathematics curriculum was adopted (Naom, 1998). This was a result of the scientific revolution that began in 18thcentury, in Britain and spread to other European countries and beyond as a result of colonialism in 19th century. However, most countries which were under colonial rule were not given the opportunity of scientific education and modern Mathematics.

In United States of America (USA), for instance, public education did not go beyond primary grades until the end of 19th century. Private academies especially for women were established in the late 1800s to provide the necessary education for admission to the universities. However, few universities admitted women although there were some institutions such as Smith College that was designed specifically for women (McGrayne, 1993 cited in Naom, 1998). Female role models were therefore missing from universities well into the mid 20th century. In the early 20th century few females could be university teachers but were prohibited from doing scientific research. Their positions were in what were considered gender departments such as home economics or physical education. Thus, lack of role models in Mathematics field came to contribute to negative attitudes towards Mathematics among girls (Naom, 1998).

In Germany, there were no Mathematics female teachers until 1920s. Also, women worked without being paid. Even today women are few in highest rank of German professoriate. There is also disapproval for women who worked outside the homes (Naom, 1998).Experiences from Tanzania show that during the pre-colonial period the purpose of learning Mathematics was to equip members of society with mathematical tools which were necessary for the day to day needs of the indigenous people (Mmari, 1995). Traditional Mathematics was based on four numerations of addition, subtraction, multiplication and division. Modern counting techniques were introduced by the Arabs before the coming of Europeans. They established Koranic schools in the trading centres in which no doubt, basic knowledge of reading the Koran was provided together with elementary mathematical skills (Howie and Plomp, 2000).

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Methodology

The study employed descriptive correlational design. Correlation was used to determine the relationship between lesson development and students mathematics academic performance. The researcher used quantitative approach.This method was good at providing a better understanding of the research problem. Quantitative approach was used to capture the magnitude of the study that is through percentages and frequencies. Quantitative data was collected using instruments like questionnaires and observation checklists to answer the research questions .However,its philosophy is constructivism and interpretative paradigm.

Findings/Results

Relationship Between Lesson Development and Students Mathematics Performance

The objective of this study was to establish the relationship between lesson development and students' mathematics performance in the four public secondary schools in Makindye Division, Kampala Uganda. Lesson development was measured using 11 questions in the questionnaire, which were also Likert scaled using five points, with the following rating scales; 1 = strongly disagree; 2 = disagree; 3

= Not Sure; 4 = agree and 5 = strongly agree. To achieve this second objective, data on lesson development behaviour was analysed first using descriptive statistics showing means and standard deviations and thereafter bivariate tests for their significance using Pearson's correlations was done with the dependent variable (math scores) and finally testing of the corresponding hypothesis was done using simple linear regression. Results are shown in table 1.

Table 1.Showing Mean and standard deviations on extent of teachers' Lesson Development behavior

Items one Lesson Development	Mean	Std. Dev.	Interpretation	Rank
Encourages student's participation in class.	4.62	.734	Very good	1
Tells students about what he or she is going to teach and the aim of the lesson	4.52	.846	Very good	2
Follows a clear mathematics curriculum.	4.46	.866	Very good	3
Comes to class with a lesson plan	4.42	.982	Very good	4
Links previous lesson with current lesson	4.42	.964	Very good	4
Links maths content to real daily life examples	4.41	.978	Very good	6
Allows learners to give explanations in class	4.34	1.008	Very good	7
Discusses mathematics content outline with students	4.25	1.032	Very good	8
Guides learners to make groups & always gives group work	3.98	1.286	Good	9
Begins math lessons with interesting question	3.95	1.207	Good	10
Begins math lessons with interesting picture/diagram	3.11	1.440	Good	11
Average Mean	4.24	.576	Very good	

Source:Primary source

The results in Table 1 reveal that teachers' lesson development behaviour was also rated to be very good on most of the items. It was rated highest onteachers' behavior of 'encouraging students' participation in class', with a mean rating of 4.62, which falls under very good on the interpretation scale and a standard deviation (SD= 0.734) which is relatively low, showing that the results did not differ so much. In brief, eight items out of 11 were rated very good, while the remaining three items were rated good. The average mean on students' ratings of their math teachers' lesson development behavior ($\bar{x}$ = 4.24), falls under very good on the interpretation scale, indicating that students rated their math teachers' lesson development behavior to be very good.

Students' performance in mathematics based on performance ratings

Table2 Showing ratings on Students performance in Mathematics

Performance Ratings	Math Performance in Term three 2018		Math Performance in Term one 2019	
	Frequency	Percent	Frequency	Percent
Very poor (Below 30%)	242	39.0	220	37.6
Poor (30 – 49%)	181	29.2	209	35.7
Fair (50 – 59%)	83	13.4	76	13.0
Good (60 – 74%)	78	12.6	57	9.7
Very good (75% and above)	36	5.8	23	3.9
Total	620	100.0	585	100.0

Source: Primary Data (2019)

The results in Table 2, suggesting that majority of the students in the four public schools of Makindye Division were poor performers. As it is indicated in this table2, and almost 70% or more are in the category of very poor and poor, followed by more than 13% who performed fairly. Less than 20% of all students performed good or very good in the two terms assessed. This confirms that majority of the students in the schools studied performed below average.

Table 3:Pearson Correlations for Lesson Development and Students' performance in Mathematics

Variables Correlated	r-value	Sig.	Interpretation	Decision on Ho
LD Vs Math Scores in Term3 2018	.063	.138	significant correlation	Rejected
LD Vs Math Scores in Term1 2019	.028	.525	significant correlation	Rejected

LD: Lesson Development

The results in Table 4.13 reveal that teachers' lesson development behaviour had no significant correlation with students' performance in mathematics in all the results assessed (all p-values> 0.05). The results however reveal that lesson development is positively related with students' performance in math, which means that an improvement in lesson development is likely to improve students' performance. These insignificant results imply that the good lesson development behaviours of math teachers do not help to improve students' performance in math.

In the study, the researcher tested a null hypothesis that teachers' lesson development behavior has no significant effect on students' performance in mathematics in Makindye Division public secondary schools is rejected..

Conclusion

The Pearson's linear correlation results revealed a significant positive correlation between teachers' lesson development. Theoretically, lesson development considers the actual implementation of the planned teaching-learning activities in the actual classroom situation (Wong, 2016). So it involves systematic approach for the teaching of concepts, skills and attitudes. It is therefore the classroom teaching learning activities and steps taken that lead to achievement of teaching learning objectives (Sugai, 2015). So the way such actions and activities are developed, arranged and delivered during the class time determine the way students learn and therefore their learning success. The findings in this study agrees with this theoretical stand and logical framework. Yet on the other hand, descriptive findings of this study revealed that teachers' lesson development behavior were very good and so we would expect to have students with very good marks because the theorized relationship is almost linear. Previous literature does agree with logical expectations that good lesson development results into good performance results because it involves steps towards motivating learners to the content being taught and other actions like linking current topic to previous and what is already known, hence the saying 'from known to unknown'. This behavior tends to motivate learners' curiosity because they are learning what already makes sense to them (Sugai, 2015).

The findings of this study revealed three important aspects of actual lesson development, which were also rated very good and good respectively, which according to Wong (2016) are the actual ingredients of good lesson development. Students rated their teachers very good on the activity of linking previous lesson with current lesson, linking mathematics content to real daily life examples and allowing learners to give explanations in class. They also rated good these actions of their math teachers; beginning math lessons with interesting question or picture/diagram. While these results seem to be deviating from what is expected by most scholars, some other effects of good lesson development could not be measured in this study. For example, Simonsen (2015) indicated that good lesson development should result into students developing their own thinking, reflections and experiences. But the type of examinations given does not clearly measure such these attributes.

Recommendation

For lesson development, math teachers need to improve on the way they begin their lessons to attract their learners more. The study recommends that the teachers should provide guidance to their students in order to be able perform well in mathematics It is also

recommended that teachers should create favorable learning environments through ensuring a good relationship with their students so that they can ask questions whenever they do not understand hence improve on the performance in mathematics

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