

Mathematics Teachers Awareness of Teachable Moments in Nigerian Classroom

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Received 25 June 2017 • Revised 20 August 2017 • Accepted 1 October 2017

ABSTRACT

Mathematics, being the core subject that has its application in every other subject should be given special attention. Despite the importance of mathematics, students are not performing in the subject. Students view mathematics in abstract form. Ways of improving the teaching and learning of mathematics should be the concern of the stakeholders. A lot of research work were reported on teaching strategies, but the problem of poor performance has not been reduced to minimal level. Students thinking and error made in class can be used to create teachable moments. This study investigated whether the teachers of mathematics in Nigeria are aware, managing and using teachable moments when occur in mathematics class. The study is a descriptive research of the survey type. The sample consisted of 98 mathematics teachers randomly selected from thirty secondary schools from both Lagos and Oyo states of Nigeria. A researcher-designed of effective management of Teachable Moments which consists of 3 parts was used to collect data from the respondents. The first section of the questionnaire was used to elicit general information on teachers' demographical data. The 3 parts of the second section include awareness of teachable moment (ATM), Management of Teachable Moment with resources (MTM) and Use of Teachable Moments (UTM). All instruments were validated. The reliability coefficient of ATM, MTM and UTM using Cronbach alpha were 0.72, 0.78 and 0.69 respectively. Means and standard deviation were used to analyze the data. It was discovered that the means of the awareness and management instruments were greater than the baseline mean (2.5). Teachers are aware, can manage but are not using the moments due to time constraint. This indicated that mathematics teachers in Nigeria are aware of teachable moments, managing the moments effectively but have not been using teachable moments.

Keywords: teachable moments, mathematics classroom, awareness, management, use

INTRODUCTION

Mathematics is a core subject that has its application in every other subject whether sciences, arts, social sciences, and commercial. Apart from the application in different subjects the day to day application of mathematical knowledge virtually in everyone's life cannot be overemphasized. Throughout the history of man down to this time, mathematics has been tremendously useful in very many aspects of human endeavours and the uses still continue. This is the reason why mathematics is regarded as an essential tool in many fields of study including natural science, engineering, medicine, finance or social sciences generally and arts. Akinoso (2014) emphasizes that, knowledge of mathematics is very essential in workplace, major employer in every sector made clear need for people with appropriate skills in mathematics. Requirements for mathematical skills in workplace have been examined with detail in a report, mathematics skills in workplace Hoyles, Wolf, Molyneux-Hodgson and Kent, (2002); Smith, (2009). Ways of improving the learning of Mathematics should be the concern of all education stakeholders. Teachers of Mathematics have a lot to do in order to communicate meaningfully to the learning of

Contribution of this paper to the literature

- The teachers of mathematics in Nigeria are aware of teachable moments and can use the moments effectively to improve the learning of mathematics using students' mathematical thinking.
- Teaching experience has nothing to do with the awareness, management and effective use of teachable moments.
- The amount of time/period used in teaching has great effect on the use of teachable moments. In this case, for effective use and to enhance sustainable development goal, a double period should be introduced to mathematics teaching timetable.

this subject especially by taking the advantage of students' mathematical thinking in connection with teachable moments.

Teachable moment is an event which presents a good opportunity for learning. In Mathematics class, teachable moment provided an opportunity for learning certain aspect of mathematical concept that might not be in consideration when planning the lesson but due to intuition of the present discussion came up and if treated properly can definitely add to students learning and retention. Students' mathematical thinking can be used as a teachable moment. This moment is very important to observe in Mathematics class since this can lead to learning and retention especially if the teachers in charge really know how to use the period meaningfully. Identification of this period is very important, although skilled mathematics teachers and teacher educators often "know" when interruptions in the flow of a lesson provide an opportunity to modify instruction to improve students' mathematical understanding, others, particularly novice teachers, often fail to recognize or act on such moments.

Mathematics classrooms wherein the teacher promotes mathematical discussion based on students' mathematical thinking and then orchestrates that discussion in ways that facilitate deeper mathematical thinking, provide opportunities for students to meaningfully "struggle with important Mathematics," something that research has shown is critical for students to learn with understanding (Hiebert & Grouws, 2007; National Council of Teachers of Mathematics, 2007). Whenever students reason out the thinking about what is being thought, and the teacher turn it to a teachable moment which is being manipulated, and discuss thoroughly, such students will find it difficult to forget that particular aspect of the concept.

The ideas generate by students should be listened to carefully and pursue in depth, this carefully pursuit of students' mathematical ideas refer to as student mathematical thinking while the opportunities to use students mathematical thinking is referred to as teachable moment (NCTM 2007). The students' mathematical thinking according to Peterson and Leatham (2013) is the students' solution strategies, justifications and reasoning, the students' models and representations. The observation and use of students' mathematical thinking will increase students' mathematical understanding. Teachable moment is not a well-defined construct in the literature, the idea of teachers capitalizing on students' mathematical thinking in the moment is frequently discussed in the literature on mathematics classroom, example of such literature includes Doerr, (2006); Manouchehri and John, (2006), Schoenfeld and Kilpatrick (2008).

Plumbing students' conceptual errors may represent fine teachable moments. Teachable moments might be an unplanned, unscripted slice of an ordinary class, but, students can learn from error committed when answering teachers question or solving problems on the board and turning this error to teachable moments might take time but allow every student to learn from such mistake. Active learning is a term used to describe a range of teaching practices that encourage students to think during class rather than listen passively. The benefits of active learning approaches in science and mathematics courses have been well-studied, Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt, Wenderoth, (2016). Effective teaching according to Erickson (2013), requires careful listening since its builds on how students think and to use students' mathematical thinking, teachers need to listen with the intent of using that thinking in order to build the classroom understanding of the mathematics.

Apart from the knowledge of mathematics concepts, awareness of any classroom occurrence that can lead to learning in mathematics class is very germane. Having the knowledge of the existence of such occurrence will then lead to planning on how to manage and use the moments effectively. Effective management of teachable moments is very essential so the students can learn from it. How to manage the moment is now the concern of teachers of mathematics. This can be done using different resources that attract the attention of students and require active participation of students. The basic ingredient in leaning of mathematics is active participation of learners (Akinoso, 2016)

The use of teaching resources is very important in mathematics class to add value and in making sure that teaching is being carried out using real-life materials to make learning real and visible. Apart from human resources which are mathematics teachers, there are material resources which include the relevant items found in the immediate environment of the learner but can enhance learning. Other resources might include the use of Information and Communication Technology (ICT) such as whiteboard, interactive whiteboard, tablets, mobile

phone, graphing calculator, Overhead projector and other technological resources. These resources can also help the teachers of mathematics to visit some website teaching mathematics. A lot of knowledge can be gained by the teacher through the use of resources connecting what the teacher is teaching find out more information on what he is teaching to get instant response and reduce the level of difficulties of some concepts in mathematics. How teachers are managing the resources for teaching mathematics was considered in this study. The teachers of mathematics should then find a way of managing the teachable moment when occur in mathematics classroom so as to enhance the learning of mathematics and reduce the rate of failure in the subject.

Due to the relevance of mathematics to everything in life, and poor performance of the subject at every level of education as well as low enrolment ratio in higher institution both for mathematics as a course and other related subjects especially sciences and social sciences like economics and others, a way of addressing these issues even to teach without too much stress should be the concern of the teachers of mathematics and other stakeholder. One of the ways is to teach the subject and ensure that students learn, this can be through storytelling and others. Kelley (2017) stated that finding real-world opportunities for extra learning, or a “teachable moment,” can really help lessons stick for students. The way and manner the teachers manage teachable moment in mathematics classroom matters, since every student can benefit from the moment and learn specific things in mathematics. Time is very important and major factor when discussing the management of any moment. (Meador, 2017), time is a precious commodity for teachers. The teachers of mathematics have to manage effectively the limited time given to teach in order to create and have enough time to manage the teachable moment when occur during teaching so as to make meaningful and productive use of the limited time. Time management is very essential in anything we do, no matter the time given, if properly managed can still give room for use of teachable moment in mathematics class. The teacher should plan the available time thoroughly.

The use of teachable moments effectively as at the time occur, the believe is that the students are psychologically ready for learning that particular aspect whether in the concepts teaching presently by the teacher or not. If the teacher of mathematics decides to use the time effectively, not regarding to it as a wasting of time and not to procrastinate especially by postponing the learning of such issue raised till the time they have related topic, it will help the students a lot. Also, if the moment does not occur, the teachers of mathematics can create one. There are so many questions the teachers of mathematics can ask to create teachable moment leading to series of response that can call for argument and explanations. The teachable moment if handled well is the time that involves all, making classroom lively and more of fun, not only the students that will learn during this period, the teachers also will gain some knowledge from the response of the students. There are so many things to learn from these students especially this era of technological age in which without learning, they can operate, interpret and move to any level in technology that can even lead to learning of mathematics. This means, learning from student mathematical thinking.

STATEMENT OF THE PROBLEM

Mathematics, being the core subject that has its application in every other subject should be given special attention. Despite the importance of mathematics, students are not performing well in the subject due to the different levels of learning difficulties. Students view mathematics in abstract form. Ways of improving the teaching and learning of the subject must be the concern of the stakeholders. A lot of research work had been reported on teaching strategies, but the problem of poor performance has not been reduced to minimal level. Students thinking and error made in class can be used to create teachable moments. This study investigated whether secondary school mathematics teachers are aware of teachable moments, whether the teachers are managing the moments using relevant resources and whether there is effective use of the teachable moments in mathematics class.

PURPOSE OF THE STUDY

The purpose of this study includes the following:

1. To find out whether the secondary school teachers of mathematics are aware of teachable moments.
2. To find out whether the teachers of mathematics are managing the moments with real-life resources
3. To find out whether mathematics teachers are using the moments effectively when occur in mathematics class.

RESEARCH QUESTIONS

1. Are mathematics teachers aware of teachable moments?
2. When teaching mathematics, are the teachers managing the resources that connect students with other students in the world?
3. Are the teachers of mathematics using teachable moments effectively?

METHODOLOGY

This study is a descriptive research of the survey type. The sample consisted of 98 mathematics teachers randomly selected from thirty (30) secondary schools from both Lagos and Oyo states of Nigeria. A researcher-designed Teachers Awareness of Teachable Moments which consists of 3 parts was used to collect data from the respondents. The first section of the questionnaire was used to elicit general information on students' demographical data. The second section consists of 3 parts which include, Teachers Awareness of Teachable Moments (ATM), Management teachable Moments with different Resources (MTM) and Use of Teachable Moments Management (UTM). The total number of the questions used for the three instruments is 23. All instruments were validated. The reliability coefficient of ATM, MTM and UTM using Cronbach alpha were 0.72, 0.78 and 0.69 respectively. The research questions were answered using mean and standard deviation.

RESULTS

Q1. Are Mathematics teachers aware of teachable moments?

Table 1 provided answer to this question.

Table 1. Awareness of Teachable Moments

S/N	Questions	Mean	Std.Dev.	Decision
1.	I have heard of Teachable moments	3.17	.79	Agree
2.	When teaching I asked students different questions	3.35	.54	Agree
3.	I respond to students answer to bring out more facts	3.14	.63	Agree
4.	Through the student response, I create more questions to create student thinking	3.10	.67	Agree
5.	If any students should ask question outside what I am teaching, I will seriously give detail explanation	2.91	.90	Agree
6.	I create more avenue to twist student response due to awareness of teachable moments	2.72	.92	Agree
7.	I know how to handle teachable moment in my class	3.11	.79	Agree
8.	Awareness of teachable moment gives me opportunity of handling students with different learning ability	3.26	.66	Agree
9.	I teach according to students need to make sure they learn due to awareness of teachable moment	3.15	.75	Agree
10.	Awareness of student thinking gives me opportunity to catch teachable moment	3.15	.84	Agree
11.	I use teachable moment to the advantage of my student and make every moment count due to the awareness	3.2	.77	Agree

From the results in **Table 1** compare to baseline mean ($x = 2.5$), it was discovered that, the mean of every item of the questions is greater than the baseline mean. The teachers of mathematics agreed with all the questions asked on this table, that means they all agreed with the awareness of teachable moments. This implies that, the teachers of mathematics in Nigeria precisely Lagos and Oyo states are aware of teachable moments. This answered the research question 1 on awareness of teachable moments.

Q2: Are the teachers of Mathematics really managing teachable moments when occur in class with real-life resources?

Table 2 provided answer to this question.

The results on **Table 2** shows that, mathematics teachers are managing the teachable moments in class with different resources that connect student to the world. Real-life examples were given to illustrate with details explanation. This answer the second research question that mathematics teachers are managing the teachable moments with internet resources.

Table 2. Management of Teachable Moments in Mathematics Class

S/N	Questions	Mean	Std.Dev	Decision
12.	I search internet to relate what to teach with real world	3.31	.71	Agree
13.	I discuss the relevant of the concept teaching to real world with students	3.34	.58	Agree
14	Student enjoy the way their questions were handled in class with real life examples and relating it to other countries	3.42	.60	Agree
15	The way I handle the questions\creating teachable moment interest students	3.22	.70	Agree
16.	Students learn more fact during my lesson due to creation of teachable moment	3.32	.67	Agree
17.	Learning of mathematics in my class create more fun due to special attention to questions and response	3.29	.74	Agree
18.	More contributions were gotten from students during my lesson which allow everybody to learn	3.14	.77	Agree

Table 3. Use of Teachable Moments (UTM)

S/N	Questions	Mean	Std.Dev	Decision
19.	I know how to use teachable moment to the advantage of my students	3.20	.74	Agree
20.	The limited time given to teach cannot allow me to observe any teachable moment	2.51	.85	Agree
21.	The number of topics to cover cannot give room for observing any teachable moment	2.41	.93	Disagree
22.	Observing teachable moment is a wasting of time	1.96	.92	Disagree
23.	I don't have wide knowledge of the concept to talk of addressing additional question	2.17	.99	Disagree

Q3: Are the teachers of mathematics using teachable moments effectively?

Mathematics teachers believe that they know how to manage teachable moment, but teachers of mathematics are not using teachable moments due to the time frame. This is because, the average mean obtained for use is 2.45 which is less than the baseline mean of 2.5. The teachers are not using it due to the limited time given to teach. This has to do with the teachers' response to question 20 in which the teachers agree that the limited time given to teach cannot allow them to observe any teachable moment. With regardless to the number of topics given to teach, the teachers still believe that they can observe the moment, they do not count the moment as a waste of time and the teachers believe that they have wide knowledge of the concepts teaching and can go extra mile to address any question asked by students even when teachable moment is created.

DISCUSSION

From **Table 1**, it was discovered that the teachers are aware of the teachable moments with this shows that greater number of Mathematics teachers both in Lagos and Oyo states have the knowledge of teachable moments. Awareness of this moment is important so as to serve as an additional advantage to the ways students learn. Learning from students' thinking and error committed is a good way of learning which result into retention. Teaching in the ways that are envisioned in the mathematics reform documents where teachers ask for, listen to, and make sense of students' ideas require a host of skills, knowledge and dispositions that are not well understood (NCTM, 2000).

It was discovered that mathematics teachers are managing the teachable moments in class with different resources that connect student to the world. Real-life examples were given to illustrate and for given details explanation. Also, mathematics teachers believe that they know how to manage teachable moment, but teachers of mathematics do not use teachable moments due to the time frame. This is because, the average mean obtained for use is 2.45 which is less than the baseline mean of 2.5. The teachers are not using it due to the limited time given to teach the teachers agree that the limited time given to teach cannot allow them to observe any teachable moment. With regardless to the number of topics given to teach, the teachers still believe that they can observe the moment, they know to manage the moment they do not count the moment as a waste of time and the teachers believe that they have wide knowledge of the concepts teaching and can go extra mile to address any question asked by students even when teachable moment is created. Time is the great issue affecting the management and use of teachable moments in mathematics class.

Time is a resource that affects all aspects of human endeavours. It is a resource that is extremely limited in supply and it is a factor that affects all stakeholders in educational sector - students, teachers, administrators, supervisors (Kayode & Kayode 2015). Instances now abound where teachers complain of lack of time to do certain things which would have done (Ekundayo, Konwea & Yusuf 2010). A good teacher must make effective use of his time to have time for everything planned to do. Good time use skill will enable the teacher to devote a balanced attention to interpersonal relations and production (Ekundayo, Konwa & Yusuf. 2010). Without been told, maximization of the use of time for academic activities is very essential. Mathematics in particular needs effective

use of to boost the interest of students in learning, also, to enhance students' academic performances and attitude. Kolbe, Partridge and O'Reilly, (2011) also attested to the use of time in academics' settings, referred to it as one of the problems with instructional time is that education lacks a comprehensive national profile of the range and incidence of the policies and practices that describe in-school learning time. Meaningful use of the available in teaching mathematics has therefore become imperative. Therefore, the effective teachers of mathematics should ensure that students are appropriately engaged in instruction for as much of the available time as possible.

CONCLUSION

It was established in this study that, the teachers of mathematics are aware of teachable moment, they know how to manage teachable moment and though, also know how to use the moments but, have not been using the moment due to the limited time given in teaching. In other words, time is the only barrier delaying the teachers of mathematics in using teachable moment in mathematics classroom.

RECOMMENDATION

Having considered the results of this study, the following recommendations were made to create room for effective use of teachable moments in mathematics class. The teachers of mathematics should plan the teaching and make effective use of the time to create time for the use of teachable moment. The teachers of mathematics should make sure that they upgrade their carrier to update their career status, increase their knowledge and be current on new update in mathematics teaching through seminars, symposiums, workshops and conferences. The school authority should instruct the timetable planner to include at least a double period of mathematics on the time table, encourage and give the teachers permission to attend programs that will lead to career development and in-service training. The government and Non-Governmental Organization should help in providing resources that will aid learning of mathematics.

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