EMPOWERING LEARNERS IN A DIGITAL WORLD THROUGH INNOVATIVE TEACHING METHODS IN MATHEMATICS.

By

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ABSTRACT

Learning of mathematics should be faced with utmost seriousness and dedication because of its numerous benefits to the society. It should be practically embedded with logical and analytic thinking in order to empower the learner. This study tried to me of the innovative methods of teaching mathematics and the extent to which they can empower the learners. This study adopted a descriptive survey research design where a sample of 140 mathematics teachers that participated in the 2017 West African School Certificate Examination marking was used. The instrument for data collection was a questionnaire structured by the researchers, made up of 20 questions to elicit information that gave answers to the research questions. The instrument was validated by three experts, one in measurement and evaluation, two in mathematics education. A reliability coefficient of 0.76 was obtained through Cronbach Alpha formula. Four research questions guided the study and were analyzed using mean and standard deviation. The results showed the innovative methods being practiced by mathematics teachers in Enugu State and also the extent to which the use of computer/internet, individualized and self directed learning strategies could empower the mathematics learner. Recommendations were made which includes: that the government should help teachers with the facilities that will enable them use the innovative methods of teaching mathematics in order to empower the learner contextualize meaningfully in a digital world.

Keywords. Empowering, individualized learning, innovative, analytic thinking, self directed learning.

Introduction

Mathematics is a subject that is indispensable in everyday life. According to Sam-Kayode & Salaman (2015), Mathematics is an essential school subject that has its relevant in all fields of human endeavour. It is a branch of science which deals with numbers and their operations through calculations, computation, critical thinking and solving of problems. Odebode (2018) pointed out that mathematics has powers of reasoning, creativity, abstract or spatial thinking, problem thinking ability and effective communication skills. There is no field of study that will say that mathematics is not important. it plays a predominant role in the development of science and technology and should not be toiled with in any society. Despite the importance of mathematics, students perform poorly in both external and internal examinations (Akanmu & Fajemidagba,2013, Sunday,Akanmu & Fajemidagba,

2014,and Zakariyya,Ndagara &Yahaya 2016). This ugly situation is contradicting the importance, usefulness and respect accorded mathematics as one will expect that the great recognition given to mathematics will translate to a satisfactory performance of the students in the subject.

Poor performance of students in mathematics is attributed to many factors such as; students' nonchalant attitude (Elekwa, 2010), students' mindset (Ihendinihu, 2013), mathematics phobia (Odebode, 2018), method of teaching (Ezeh, 2010). The method a teacher uses in imparting knowledge to the students has great impact on the performance of the learner. Researchers have used a number of methods in teaching mathematics to see if there will be improvement in the performance of the students(Zakariyya, Ndagara &Yahaya, 2016). Adeniji &Salman (2016).

Empowerment is the process of becoming stronger and more confident, especially in controlling one's life and claiming one's right. Empowerment is the process of helping learners to be independent. Empowerment is also a process of helping learners to become aware that they can have an impact on their environment and can exert some control over their circumstances. Esochaghi (2015) defined empowerment as moving from enforced powerlessness to position of power. Learner empowerment in the context of this study is preparing learners to have confident, motivation, creative, self reliant and self efficacy so as to face the day to day activities. A learner that is empowered is expected to make meaning to what he has learnt through his beliefs and ideals. In the same vain the learner should be competent to the extent of handling his work effectively. Dinant (2015) opined that empowerment has four dimensions stated as follows 1) meaningfulness 2) competences 3) impact 4) Choice. In these four dimensions, it could be inferred that for a learner to be empowered, he/she should be embedded with the above virtues. Dinant (2015) goes further to define students empowerment as any attitudinal, structural and cultural activity process or outcome where students of any age can gain the ability, authority and agency to make decisions and implement changes in their own schools, learning ,education and in the education of other people. A student who passes through mathematics teaching through the innovative methods is expected to acquire what it takes to be independent, self-reliant, through implementing changes in him or to others. A student taught mathematics through the use of the computer is expected to understand the concept better, have confident in handling mathematical problems and his day to day activities, acquire skills that can provide job.

Learning is achieved through education as a process of imparting or transferring knowledge to the learner. This could be done through the use of teaching strategies to instill confidence to the learner. Teachers use a number of teaching strategies to impact knowledge to the learner especially in this digital world. Such strategies includes: the use of computer, internet student directed learning, individualized strategy, brainstorming, concept mapping, observation, peer group tutoring among others. Teacher's choice of teaching strategy or combination of teaching strategy depends on the objective of the lesson as every teacher will like to achieve the set objective in teaching especially in this digital world where nothing is hidden. Any unfinished work will reflect on the output. That is on the

performance of the students. The performance of the students to a large extent tells how well the teacher has taught. Technology flourishes every day and has brought a lot of improvement in the education of the child through the use of computer, internet and other programmed instructional strategy. Some of the methods are innovative in the sense that they have introduced new ideas, creative thoughts or new imaginations in the form of device or method (Wikipedia,2019). Innovation is also an application of new solution to an existing problem. A number of methods have been used in teaching mathematics but any one with new idea is regarded as innovative in the context of this work. This study is considering the use of computer, self-directed and individualized learning as innovative methods. Some researchers have carried out research works in some of the innovative methods.

Usman, & Ezeh (2011) carried out a study on computer as tutor and tool in mathematics instruction for the attainment of millennium development goals and found out that students learn better when computer is involved than when it is not involved. This goes to affirm the digital trend of the present day students where students use the handset to browse, compute and the internet to do a number of things. Etukodo (2010) in his own view upholds the use of computer and programmed instruction in teaching of mathematics for effective service delivery. Bot & Iliya (2015) opined that programmed Instructional strategy is effective in teaching mathematics as it enables the learner to learn new concepts in small, sequential and analytic steps without direct or closer involvement and intervention of the teacher. Technology is one avenue that makes students use creative means to describe a mathematical concept through video, animation, diagram or perhaps a concept map (Rahul, 2016)

The digital world explains how computer hardware, software, networks and systems work. It as well brings in how the internet and the web operate. Every day the world unveils itself that we are in a digital world where we read news in our smart phones, read e-books and do online banking. Apart from the use of the computer, there are other innovative methods like the individualized and self directed learning.

Individualized learning is a learning strategy where the learner is given a special attention and allowed to learn at his/her pace instead of following the crowd. (Sebastine, & Valjataga 2011) defined individualized learning as a method of teaching in which content, instructional technology and pace of learning are based upon the ability and interest of the learner. It is a learning experience in which the needs of the individual learner are considered. Though the students follow the same curriculum and experience, but they do that at the individual's pace. Individualized learning encourages students' ownership of their learning process; focus on the learning process instead of waiting for the end year examination, mastery of a concept before transiting to another and finally learning can take place any where any time. In today's world where technology is the talk of the town, individualized learning could be useful as some individuals may like to use the computer to learn at their own pace and time instead of the normal old school learning in the classroom without considering the individual differences and ability just like in self directed learning.

Self directed learning is a learning strategy where the individual is allowed to be in charge of what he/ she wants to learn and the modalities therein. Charlotte and Lars (2008) considered self directed learning as a core concept in problem-based learning where the individual will be in charge of his learning situation. In a self directed learning, the learner will be responsible for his learning and will be independent. Patterson, Crooks and lunyk-Child (2002) as cited in Charlotte and Lars(2008) described six competencies required to become self-directed as; self assessment of learning gaps, evaluation of self and others, reflection, information, management, critical thinking and critical appraisal. In self-directed learning, the students select and investigate topics of their own choice, what to use in learning it and how to learn.

Statement of the Problem

Mathematics is an important subject used by everybody in the society both directly and indirectly. It is a core subject in both the primary and secondary schools. Despite the importance of mathematics and efforts of mathematics teachers and researchers to improve on the performance, there is still low performance of students in Mathematics. The poor performance in mathematics has not come to a halt. It is against this background that this paper seeks to feature how the use of computer/ internet, self-directed and individualized learning strategies can empower learners in a digital world.

There are a number of skills embedded in the knowledge of mathematics if well taught. The skills of critical reasoning, analytic thinking, creativity and orderliness which will empower an individual to stand out among equals are all in mathematics. These skills can only be achieved if one has learnt the mathematical concepts taught. Mathematics teachers use a number of methods in teaching mathematics to instill these skills in the learners but the poor performance showcased in external examinations by students is an indicator that the knowledge was not properly acquired. This may be why most students on graduation do not use the knowledge acquired to start up something and be empowered. It is against this background that this study tries to find out the various methods used by teachers in teaching mathematics and the extent to which some innovative methods could empower the learner.

Aim & Objectives of the Study

The aim of this study is to find out the methods used by mathematics teachers in teaching mathematics in Nsukka Education zone and how learners could be empowered through such methods. Specifically, the objectives of the study areFind out the various methods used by mathematics teachers in teaching mathematics

1) The extent to which computer/internet could empower the learner
2) The extent to which individualized learning could empower the learner
3) The extent to which self directed learning could empower the learner

Research Questions

1) What are the various methods used by mathematics teachers in Nsukka Education zone
2) To what extent could the use of computer/internet in teaching mathematics empower learners
3) To what extent could the use of individualized learning empower the learner
4) To what extent could the use of self-directed learning empower the learner

Methodology

This study adopted a descriptive survey research design to find out from teachers the methods they use in teaching mathematics and also how innovative methods could empower the learners. This type of design is appropriate as it will enable the researchers to get information from teachers for extensive research. The population of the study is all the mathematics teachers in Nsukka Education zone of Enugu-State making a total of 1,360 mathematics teachers from which 140 mathematics teachers that participated in 2017 WAEC marking formed the sample. All the mathematics teachers that participated in the marking were used as the sample as they came from various schools in Nsukka zone. The instrument for data collection was a questionnaire structured by the researcher named Questionnaire for empowering learners through innovative methods (QELTIM) to answer the research questions. There was a total of 20 items in three clusters to answer research questions 2,3 and 4 while research question 1 will be answered through percentages. The questionnaire was made up of two sections; section A elicits information on the demographic data of the respondents while section B elicits information for answering the research questions, cluster by cluster on a four point modified Likert scale of very high extent (VH), high extent (HE), low extent (LE) and very low extent(VLE). Cluster one is a list of various methods that could be used in teaching mathematics where teachers will be expected to tick the method they use or they are familiar with. The instrument was validated by three experts, two from Mathematics Education and one from Measurement and Evaluation of Michael Okpara University of Agriculture, Umudike, Abia-State.

The reliability of the instrument was determined through Cronbach Alpha with a reliability coefficient of 0.80. A total of 140 copies of the questionnaire were distributed to mathematics teachers and retrieved after filling to avoid loss of any one. Research questions were answered using mean and standard deviation. Research question 1 was answered using percentages where any percent less than 50 is regarded as low while 50 and above is regarded as high. To answer research questions 2 to 4, real limit of numbers were used thus: Very High Extent = 3.50-4.00, High Extent= 2.50-3.49, low Extent=1.50-2.49 and Very Low Extent =1.00-1.49.

Results

Findings of the study were displaced on the tables according to research questions

Research question 1: What are the various methods used by mathematics teachers in Nsukka Education zone?

Table 1: Methods of teaching Mathematics

S/N	METHODS	No of respondents	Percentage	Decision
1	Lecture	120	86%	H
2	Inquiry	20	14%	L
3	Delayed formalization	5	4%	L
4	Use of computer/ internet	40	29%	L
5	Laboratory	50	36%	L
6	Cooperative	7	5%	L
7	Peer-tutoring	5	4%	L
8	Individualized	4	3%	L
9	Self- directed	6	4%	L
10	Brain storming	2	1%	L
11	Concept map	12	9%	L
12	Pear tutoring	6	4%	L
13	Mind map	3	2%	L

H means high while L means low

Table 1 shows a list of methods used by teachers in teaching mathematics. Some of them are commonly used while others are not. Some are innovative while some are not. The table also reveals the percentage accorded to each teaching method based on the responses of the teachers. This indicates that most teachers still use the lecture method even with the existence of other methods as it had a percentage of 86, though other methods are used but in at a low rate.

Research Question 2: To what extent could the use of computer/internet in teaching mathematics empower learners?

Table 2: Mean and standard deviation of respondents on the extent to which computer/internet can empower learners

S/N	ITEMS	Mean (×)	SD	DECISION
1	Use of computer can facilitate learning	3.66	.59	VHE
2	The use of internet can empower learners through information	3.65	.62	VHE
3	To what extent can the internet expose students to opportunities	3.66	.56	VHE
4	To what extent can using the computer enhance critical thinking in students	3.39	.72	HE
5	To what extent can mastering the keyboard improve students' analytic thinking	3.68	.71	VHE
6	To what extent could learning mathematics with the computer empower learners	3.61	.72	VHE

7	Computer/internet can enable learners acquire job and work related knowledge	3.50	.91	VHE

VHE = Very High Extent

Table 2 shows the means and standard deviations of responses on the extent by which computer can empower learners. All the means were within the real limit of 3.50-4.00 except for item 4 which is within the real limit of 2.50-3.49. This indicates that the respondents believed that the use of computer in teaching mathematics can empower learners as most of them affirmed the very high extent option.

Research question 3: To what extent could the use of individualized learning empower the learner?

Table 3: mean and standard deviation of respondents' opinion on the extend individualized learning can empower learners

S/N	ITEMS	Mean (X)	SD	DECISION
8	Learning of mathematics is easier when individualized learning is applied	3.42	.91	HE
9	Proper understanding of mathematics concept is better with individualized learning	3.29	.96	HE
10	To what extent could attending to individual learner's problem empower his mathematical ability	3.36	.96	HE
11	Individualized learning can empower learner to be self reliant	2.75	1.30	LE
12	Brainstorming is readily available with individualized learning	3.44	.88	HE
13	Individualized learning can improve students' eagerness to study	3.00	1.07	HE

HE = High Extent,

Table 3 shows the means and standard deviations of respondents on the extent by which individualized learning can empower learners. Means were within the real limit of 2.50 – 3.49 which indicates that the respondents believed that the individualized learning can empower learners to a high extent.

Research question 4: To what extent could the use of self-directed learning empower the learner?

Table 4: means and standard deviation of respondents on how self-directed learning can empower learner?

S/N	ITEMS	MEAN(X)	SD	DECISION
14	Self directed learning enables a learner to work at his own pace	3.72	.94	VHE

15	Empowerment of learners are more when self-directed learning is employed	3.54	.88	VHE
16	To what extent could learners be empowered through self –directed learning	3.51	.88	VHE
17	To what extent could self-directed learning help learners to be self reliant	3.51	.83	VHE
18	Self-directed learning encourages critical and analytic thinking	3.24	.83	VHE
19	Coverage of content is more through self-directed learning	3.24	1.01	HE
20	Students readiness to learn could empower learners	3.43	.98	HE

VHE= Very Extent, HE= High Extent

Table 4 shows the means and standard deviations of respondents on the extent by which self-directed learning can empower learners. Means of items 14 -17 were within the real limit of 3.50– 4.00 which indicates that the respondents believed that the individualized learning can empower learners to a very high extent. While items 18-20 fall within the real limit values of 3.00-3.49 which indicates that self –directed learning can empower learners.

Discussions

The results of this study indicated that mathematics teachers in Enugu state use more of the lecture method (86%) than any other method. Very few teachers use computer/internet (29%), individualized method (3%) and self –directed method (4%) which were regarded as some of the innovative methods for teaching mathematics in this study. This is in line with Usman & Musa (2015) whose study indicated that teachers still fall back to the lecture method of teaching amidst other methods .The use of computer/internet was seen as a means of empowering learners as a number of things could be achieved through it. This goes to support the work of Oladipo and Tomori(2016) whose work indicated that the use of computer motives students learning and enable them learn better. This work is also in line with the work of Usman & Ezeh (2011), who projected the use of computer as good for skill acquisition and wealth creation. The study indicated that to a high extent, the innovative methods discussed in this paper could empower learners to learn mathematics, be self reliant, create job and be independent.

Conclusion

The findings of this study gave evidence that mathematics teachers in Enugu State use more of the lecture methods than any of the innovative methods of teaching mathematics. This has strong implication to the teaching and learning of mathematics in the sense that when teachers teach while students listen, it makes students passive and non productive in the class room. Teachers should as well embrace the innovative methods like the use of computer, individualized learning and self directed learning as they empower learners.

Recommendations

Based on the findings of this study, the following recommendations were made

1) Teachers should make use of the innovative methods in teaching to enable the students learn better and be empowered
2) The State and Federal Ministries of Education should provide computers to schools to enable teachers make use of them in teaching
3) Teachers should be go for training so as to learn how to use innovative methods in teaching mathematics

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