

# TOWARDS THE ACQUISITION OF KNOWLEDGE FOR THE UTILIZATION OF MATHEMATICS INSTRUCTIONAL MATERIALS FOR EFFECTIVE TEACHING AND LEARNING OF MATHEMATICS BY MATHEMATICS TEACHER-TRAINERS' IN COLLEGES OF EDUCATION IN ZAMFARA STATE, NIGERIA

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## **Abstract**

*The purpose of this paper was to find out whether (1) the instructional materials, which in the context of this paper comprised of (overhead projectors, multimedia projectors, computers, workshop equipment and consumables, which were supposed to be supplied to the Mathematics Laboratories /Workshops of Zamfara State Colleges of Education were actually supplied or not. (2) If they were supplied, do the Mathematics Teacher-trainers in the two colleges of Education concerned; know how to utilize them for their mathematics classroom instructions? (3) If not, what were the reason(s) for their lack of knowledge? The target population comprised of two (2) colleges of education which are the only colleges of education in Zamfara State Nigeria. They are Federal College of Education Technical Gusau, in Gusau Local Government Area and State College of Education Maru, in Maru Local Government Area, all in Zamfara State, Nigeria. All the nine (09) Mathematics lecturers' from Mathematics Department in Federal College of Education Gusau and six (06) out of the seven (07) Mathematics Teacher-Trainers from College of Education Maru participated in the writing of this paper, hence, completed the questionnaire designed to address the research questions. The information gathered from the completed questionnaire revealed that (i) the instructional materials (overhead projectors; mini and micro computers and the multimedia projectors meant for the two colleges Mathematics Laboratories were not supplied and that the Mathematics Laboratories are not even in existence. Some of the equipment meant for the Mathematics Workshops are conspicuously absent, more especially those of College of Education Maru. The consumables which are cheaper in rate are the ones mainly supplied with the omission of just a few. (2) No workshops have been organized to train the Mathematics Lecturers' on how to use these instructional materials for effective delivery of their lessons, hence their lack of knowledge of how to make use of them while teaching. (3) The teacher-Trainers didn't put up any personal effort to learn how these instructional aids can be utilized for effective teaching and learning of mathematics. The paper was concluded with recommendations advanced on how this situation can be remedied. Among the recommendations advanced were that (1) importance should be attached to peer support and collaboration among the staff of the various colleges of education within the state and even in the same college, so as to help create avenue for assistance from each other when the need arises. (2) there is need for series of workshops to be organized by National Commission for Colleges of Education (N.C.C.E.) who is in charge of all the Colleges of Education in Nigeria and whose "Minimum Standard" spelt out all the instructional materials that were supposed to be supplied to all the colleges Mathematics Laboratories/Workshops. She can organize these workshops alone or in collaboration with the various college authorities, so that the Mathematics Educators (Teacher-Trainers) can be acquainted with the ways these teaching materials can be utilized for effective teaching and learning of mathematics.*

**Keywords:** instructional materials, acquisition of knowledge, utilization, Mathematics Teacher-Trainers, effective teaching and learning.

## Introduction

Right from the 1990s, the major focus of reform in Mathematics Education was directed towards teaching pedagogy and since then lots of articles; studies etc have emphasized the use of instructional materials for effective teaching and learning of mathematics. Modern methods of teaching have equally emphasized that classroom instructions should consist not only of “chalk and talking” but should equally consist of teachers’ constructions that are coupled with problem solving and discovery construction sessions by the students’. This important art of teaching by the teacher with the aid of instructional materials, will lead the students of mathematics to fully comprehend the mathematical concepts learnt. This perhaps is the reason why researchers of quality education emphasized that indebt knowledge of the mathematics concepts being taught by the teacher is a necessary but not sufficient condition for effective teaching and learning of the subject. According to them relationship must exist between teachers’ knowledge of mathematics content and the ability to communicate that context to learners through the use of physical models and manipulative. Odero (2010) equally noted that since success in learning is linked to appropriate and effective use of teaching and learning resources, no learning can be effective without the use of resources. He further asserted that when instructional resources are available and are used by teachers’ they help in clarifying concepts to learners, increase learning, generate interest and create a situation where the learners would fully engage themselves in classroom activities where as in their absence or ineffective use, difficulties in learning results. Effective teaching and learning of mathematics would result in having positive effect of behavioral change on the students’ learning. This would in turn pave way for higher mathematical achievement. Instructional materials are thus the materials that help teachers to present their lessons effectively and equally help the students’ to learn meaningfully. Learning is a change in behavior as a result of activity, practice and experience. Such a change in behavior is more or less permanent in nature Federal Ministry of Education (F.M.E.) Lagos (1981). According to Leyola (2015) Learning involves an active participation and optimistic approach from both the learner and the teacher to successfully achieve the desired behavioral changes. Instructional materials in the sense used in this write-up include instructional technologies (overhead projectors, multimedia projectors, mini and micro computers etc, workshop equipment like drilling machines, drill bits, engraving machines, electronic organizers etc. and consumables such as cubes, rulers, protractors, graph papers, calculators etc). The constructivists strongly believe that children need to manipulate materials in order to construct knowledge, discover things and learn mathematical concepts. Researchers’ of quality education were of the view that the use of instructional materials will make a difference to the learning of pupils and that the teacher is central to the effectiveness of instructional materials. Researchers of School effectiveness also identified the availability of instructional materials in the classroom as necessary inputs to make schools effective. Okafor and Anaduaka (2013) contended that mere telling without exposing the learners to concrete materials do not enhance learning. They asserted that a creative teacher needs to know what materials are available to enrich the teaching and learning of mathematics. Obioma (2007) suggested that teachers’ should enrich the teaching of the 9-Year Basic Education mathematics curriculum contents with relevant instructional materials as this, according to him, would help in achieving the objectives of the curriculum which pays particular attention to the achievement of the Millennium Development Goals (MDGs) and the critical elements of the National Economic Empowerment and Development Strategies (NEEDS).

The outright hatred for mathematics by lots of students (Okafor and Anaduaka, 2013), the glaring mass failure of students in mathematics in every public examination, the massive cheating of students’ in this subject (Ohakwe (2014), high rate of unemployment, high financial constraints coupled with the desire to achieve the objectives of the (MDGs) and (NEEDS) programmes in Nigeria calls for quality education in general and quality mathematics instruction in particular. There is therefore need for effective utilization of instructional materials by mathematics teachers’ for the teaching and learning of this important subject. National Commission on Science and Science teaching for 21<sup>st</sup> Century, (2015) was of the view that as a challenging subject, its learning needs can be addressed through the use of instructional materials. For the mathematics teacher to adequately and effectively utilize the appropriate instructional materials for meaningful teaching and learning of mathematics, he has to select and arrange the appropriate mathematics learning materials in a manner that will make them enhance learning. The mathematics instructional materials selected by the teacher, cannot replace the teacher, rather they should help the teacher to teach mathematics meaningfully. The mathematics teacher therefore needs to acquire a good knowledge of how to make use of the instructional materials at his jurisdiction, because they (instructional materials) must be accompanied by interpretation, elaboration and decision by the teacher. It is in the light of this that this paper intends to find out whether the Mathematics Teacher-Trainers’ ( Mathematics Lecturers’ or Educators) in Zamfara State Colleges of Education, have the knowledge of how to utilize the instructional materials which are supposed to be supplied to their various Mathematics Laboratories/Workshops for effective mathematics classroom instructions. It is only when they have indicated that they have the knowledge or have been taught how to use these instructional materials, that their competence in their use can be tested.

### A brief history of Zamfara State educational background.

This paper is interested in the use of mathematics instructional materials for the teaching of mathematics in Zamfara State due to this state's backwardness in education, more especially in the area of science and technology. Zamfara State is situated in the north western part of Nigeria. The reason for her educationally backwardness, dates back to Nigeria's pre independence era. During this period, the people of Zamfara State showed no interest in western education; rather they preferred to pay great allegiance to Arabic education which emphasized obedience to Allah and the constituted authority. The southern part of Nigeria however embraced western education fully. After Nigeria's independence in 1960, the imbalance in education between the north and the south became clear and there was need for change in curriculum {National Teachers' Institute (N.T.I), 2000}.

It is difficult to believe that for about fifty-four (54) years after Nigeria's independence, the imbalance in education between the north and the south more especially in the field of science and technology is yet to be bridged. It is in an attempt to bridge this gap, coupled with an attempt to curtail gender discrimination of women in education in this part of the country mostly in the field of science and technology that led the Federal Government of Nigeria to establish Federal College of Education (Technical) Gusau in Zamfara State in 1989. This institution is a female "only" technical tertiary institution and the only one of its kind in Nigeria. It is therefore highly necessary that the teaching and learning of mathematics in particular and science/technological courses in general in this institution be taken serious through adequate and effective use of instructional materials. The second College of Education in Zamfara State (College of Education Maru), is a conventional college that was established by Zamfara State Government in the year 2000. Its establishment is as a result of the need to revamp the educational sector in the state in order to meet the increasing demand of qualified teachers' to man the large number of primary and secondary schools across the state (Maru, 2002). It might however interest you to note that since the inception of these colleges, "the Mathematics Departments" of these two colleges have on annual basis recorded very low students' enrolment as against other departments in the two colleges (table 1.).

### Students Enrolment Figures in FCE(T),GUSAU and COE Maru (Zamfara State)

Table 1: Students' Enrolment Figures in Mathematics Department in comparison with a few other Departments in F.C.E. (T) Gusau from the year 2002-2013/2014 Academic Session.

Department	2002	2003	2004	2005	2006	2007	2011/2012	2012/2013	2013/2014
Mathematics	02	08	-	04	07	32	11	30	19
Building	02	-	01	-	06	09	10	07	03
Elect/Elect	05	-	-	01	11	17	09	08	06
Woodwork	--	02		--	01	--	--	--	--
Metalwork	--	--	02	--	02	01	05	03	02
Automobile	03	--	--	--	01	01	03	06	04
Physics	--	--	--	02	01	04	10	10	07
Chemistry	03	03		01	04	07	08	20	12
Accounting	48	68	19	33	120	134	113	136	145
Secretarial	23	23	21	28	36	58	80	116	128
Hausa	03	29	25	54	38	138	311	306	312
Home Econs.	17	18	04	21	13	11	33	48	46
Agric/science	11	12	--	08	18	19	26	32	41

Source: Offices of the Heads of Departments of the respective courses.

Table 1.shows that the lowest enrolment figure in mathematics for the year 2002 -2013/2014 was 02 students' in the year 2002 and the highest figure was 32students' in the year 2007 as against Accounting and Secretarial Studies in the school of Business Education which has enrolment figures of 19 and 21students' respectively as their lowest enrolment figures in the year 2004 and the highest figures of 145 and 128 respectively in the year 2013/2014 academic session. The Department of Hausa in School of Language Education had the lowest enrolment figure of 03 students in 2002 when there was not enough publicity as regards the establishment of School of Language Education in the college. Their highest enrolment figure of 312 students was in 2013/2014 Academic Session. Home Economics and Agricultural Science in School of Vocational Education had the lowest enrolment figures of 04 and 08 students in the years 2004 and 2005 respectively and highest enrolment figures of 48 and 41 students' in 2012/2013 and 2013/2014 Academic sessions respectively. Mathematics related courses like physics, chemistry, automobile, metalwork, electrical electronics, building and woodwork equally recorded very low enrolment figures within this period as can be seen in table 1.

Table 2: Students' Enrolment figures in Mathematics Department in comparison with a few other Departments in C.O.E. Maru Zamfara State, Nigeria, from 2008/2009 -2013/2014 Academic Sessions.

Department	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014
Mathematics	13	06	03	05	04	03
Physics	07	04	04	03	05	06
Chemistry	06	05	04	05	05	04
Arabic	350	465	380	450	400	510
Hausa	424	501	502	455	493	500
Social/Studies	107	126	134	152	147	150
Computer/Sc	61	47	55	54	63	70
Islam	480	562	450	400	510	600

SOURCE: Heads of Department of the various courses in the college.

Table 2.shows that the highest number of students enrolled into the Department of Mathematics in this college from 2008/2009-2013/2014 Academic Sessions were 13 students in 2008/2009 session and since then the enrolment figures have always dwindled to the point of having only 03 students admitted for academic sessions like the 2010/2011 and 2013/2014. This poor enrolment figures are also witnessed in mathematics oriented courses like chemistry, physics and even computer science to some extent. Art oriented courses like Arabic, Hausa, Social Studies, Islam etc. has a different story to tell as these departments always experience very high students enrolment.

The reason for this poor enrolment figures in Mathematics Departments might probably be because of the notion that mathematics is an abstract subject that is too difficult to comprehend. It is therefore very necessary that every mathematics classroom instruction should be accompanied with the relevant and adequate instructional materials that would help to make mathematical concepts clear and understandable to the few pre-service teachers that vied to study mathematics in these two colleges. It is therefore of optimost importance to find out whether the instructional materials, which are supposed to be made available in the Mathematics laboratories/Workshops of these two Colleges have actually been supplied. It is also necessary to verify whether "the Mathematics Teacher-Trainers' (Mathematics Educators, Lecturers) in these two colleges have acquired the knowledge of how to utilize these instructional aides for effective classroom instructions. This paper is interested in the above verifications because little or no attempt has been made in this state to take stock of the instructional aides supplied to these two colleges, neither has any attempt been made to find out whether the Mathematics Lecturers in these two colleges can comfortably utilize these teaching aids for effective discharge of their duties to their pre-service teachers'. This then calls for the mathematics educators to be very much aware that teaching (educating) is an art involving and providing avenue for opportunities where students' can develop their skills and knowledge through proper guidance of educators'. That it is a dynamic, collaborative process involving the teacher and the learner. That it entails active participation from the learner in the full realization of the opportunities presented to them and that it is a focused supervision of the course of the learning process and the process of providing guidance opportunities to students' as they engage in the experiences presented to them that will result to a comparative permanent behavioral change (Leyola, (2015).The Mathematics Teacher-Trainers' should know that "Mathematics" is not a subject to be toyed with. That it is an abstract course and should be taught as such. That for it to be an enjoyable subject, the Pre - Service Teachers' who handle this course at the Nursery/Basic School and Senior Secondary School levels should be helped to acquire the knowledge and the skills they require for handling mathematics meaningfully at this level. They should be groomed to be able to make their own instructional materials (improvised ones) in the absence of ready-made ones in the schools. The Mathematics Teacher-Trainers referred to in this paper are individuals trained technically and pedagogically in the art of teaching mathematics and are charged with the responsibility of impacting mathematical knowledge and skills to the pre-service teachers at the college of education level and are appropriately utilizing instructional materials when need be. Utilization of instructional materials refers to the use of the instructional materials by the mathematics educators for meaningful teaching of mathematics.

### **The meaning of instructional materials.**

Instructional materials according to Okafor and Anaduaka (2013) are those materials that are used to stimulate and maintain students' interest in mathematics learning as well as facilitate their understanding of mathematics topics. Asogwa, Onu, & Egbo (2013) opined that instructional materials are objects used by the teacher in passing across essential facts of a lesson to students so as to facilitate their understanding and appreciation of the objectives of the lesson.

**The relevance of instructional materials to the teaching and learning of mathematics.**

The need for instructional materials in the teaching and learning of mathematics concepts can never be over stressed. Their relevance among others is as follows. They:

- promote an appreciation of the role of mathematics as it relates to science and technology.
- Provide numerous and varied experiences that encourage students' to develop trust in their own mathematical thinking.
- Provide ongoing opportunities for students to clarify, refine and consolidate their ideas and to communicate through reading, writing and discussions.
- Help students to make conjectures, gather evidences and develop arguments to support their reasoning.
- Help students to use varieties of mathematical methods to solve non-routine problems.
- Reflect high expectations for all students' regardless of race, culture, gender religion physical condition and socio-economic background.
- Reflect an appropriate developmental sequence while allowing for teacher flexibility.
- Ensure active students' participation in learning, creating, doing and evaluating mathematics.
- Are current and reflect the diverse uses and applications of mathematics.
- Reflect the changes in the nature of how mathematics is taught.
- Integrate technology and reflect the impact of technological advancement.
- Model multiple means of assessment that can be integrated with instruction, assessing what students' know, what they can do and how they think about mathematics.
- Help students' to work together to make sense of mathematics, rely more on themselves, to determine whether something is mathematically correct, to reason mathematically, learn to conjecture, invent and solve problems, connect mathematics, its ideas and its applications to other topics within mathematics and to other disciplines.
- Help to challenge students thinking because teachers' will ask students to explain their thinking and reasoning.
- Assist mathematics educators to facilitate learning by all students'.
- Enhance, facilitate and make teaching/learning of mathematics easy, lively and concrete.
- Help to make abstract concepts and ideas concrete in teaching /learning process.
- Help to break language barriers, ease difficulties in mathematics learning and in the end make lessons more meaningful.
- Help to emphasize facts and to clarify difficulties.
- Use them for the transfer of information from one individual to another.
- Help teachers to extend their teaching horizons of experiences, stimulates learners' interest and help both teachers and learners to overcome physical limitations during the presentations of subject matter (Asogwa, Onu,& Egbo 2013).
- Help educators to present questions, have the users to indicate the answers and then provide the user with the correct answers.
- Help students' to proceed at their own pace with the opportunity of reviewing their works.
- Help to improve, supplement teachers' teaching and to extract more information from both the teachers' and the learners.
- They have the potential to help the mathematics teachers explain new mathematical concepts clearly and these results in students' better understanding of the concepts being taught.

Having noted the series of emphasis placed on the use of instructional materials for meaningful teaching and learning of mathematics, the question that needs to be asked is, how useful is mathematics to human existence?

**The meaning of mathematics.**

*Odili (2006) defined mathematics as "the science of quantity and space, a systematized, organized and exact branch of science, a creation of human mind concerned primarily with ideas, processes and reasoning. It is a body of knowledge, a collection of techniques and methods as well as the product of human activities". According to Kreyszig, (2004) mathematics is a systematic science built on relatively few basic concepts and involving powerful unifying principles with firm grasps for the interrelation between theory and experiment. Mathematics is thus the study of patterns and relationships, a science and a way of thinking, an art which is characterized by order and internal consistency. It is a language that uses carefully defined terms and symbols.*

*The need for mathematics education in Nigeria.*

Because of the great role mathematics plays in national development such as advancement in science and technology for economic development, the Federal Government of Nigeria made it a compulsory subject at the basic and senior secondary school levels in Nigeria. At the tertiary level of education, mathematics is equally made a requisite subject that must be passed by any candidate that wishes to gain admission to study in any of the nation's higher institutions of learning.

“In response to the question “what makes mathematics sciences so central”?, Anold (2003) quoted Galileo who once stated that “The great book of nature can be read only by those who know the language in which it was written, and that language is mathematics”. He further stated that” *mathematics is the way to understand all sorts of things in the world around us and that Mathematicians in Lausanne National Polytechnic University used “Partial Differential Equations” to model the flow of the sea around the hull, the dynamics of the air, the sails and the turbulent interaction of the ocean, wind and the boat. They then applied advanced numerical algorithms to solve the equations on high performance computers. This helped them to optimize such things as ‘hull and keel design, sail geometry and placement’ etc. With this knowledge, they were able to design the ‘Align’, a Swiss Boat that gave them victory in the 2003 American cup”.*

A famous philosopher “Kant” once said “Science is exact only in so far as it employs mathematics; a natural science is a science in so far as it is mathematical”.

Johnson (n.d) noted that “We use mathematics every day to count money and weigh calories. Many careers use mathematics on daily basis e.g. financial services, health care and sciences etc. The complexity of mathematics varies from one career to the next. For instance, insurance companies use statistics to determine the risk of an event occurring and the financial cost associated with that risk. It is through the statistical data collected that they develop insurance policies and calculate the premiums the company charges for its policies. Statisticians use mathematics to design polls, surveys, experiments and other methods used to collect data that is essential for a variety of business uses. They write reports regarding the data they collected and explain any limitations that surround the data.”

Architects’ use the knowledge of mathematics for the designing and building of structures such as homes, churches, restaurants civic buildings etc. They use mathematics to prepare drawings, estimate project cost and prepare contract documents for contractors working on the construction of buildings.

Economists use numbers (mathematics) to calculate and analyze numerical figures that are important to the economy as a whole and individual sector. They predict and interpret market trends. They prepare reports and presentations that show the results of their findings e.g. unemployment rates, job growth, currency rates etc

Glydon (2008) emphasized that mathematics plays a crucial role in medicine in that doctors and Nurses take care and are accurate in their medical calculations with the knowledge of mathematics. They use mathematics every day while providing health care for people. They write prescriptions and administer drugs to their patients with various ailments using mathematical knowledge. They use the knowledge of mathematics to draw up statistical graphs of epidemics or success rate of treatments and are able to determine how many milligrams of medication each patient will need depending on their body weight as well as how long a prescription will last in each patient’s body. They take note of vital signs of their patients such as their temperatures, pulse rate, breathing rate and blood pressures using the knowledge of mathematics. The Pediatricians take accurate measurement of patients’ rate of heart beats by dividing the number of heart beats by the amount of time taken. They use the knowledge of mathematics to interpret this body mass index to their patients which is expressed as fractions.  $(\text{Body weight} / (\text{Height})^2 = \text{Body mass index})$  which is an important measure of health.

Powers (2015) stated that students who seek careers in the Radiology Sciences will be best prepared if they have a strong academic preparation in mathematics and sciences.

Delebra (2015) a radiographer, stated that Understanding mathematics is critical to her ability to do her job and achieve accurate results for her patients”.

Keener and Sneyd (n.d) were of the view that teaching physiology without a mathematical dynamical processes is like teaching planetary motion to physicists without mentioning Keplers Laws. They further stated that the British Government Policy in dealing with the hoof-mouth disease outbreak a few years ago relied heavily on studies based on mathematical epidemiology.

Mathematics has been observed as Biology's next microscope (Colwell, 2003).

Mathematics remains the most serviceable subject to all disciplines and fields of human works and study (Ale, 2006, & National Teachers' Institute, 2007).

In a discussion forum where discussions were held as to why people hate mathematics as a subject, Change (profile/1732163) maintained that mathematics is a means to an end in any of man's pursuits. She added that understanding mathematics techniques provides one with many tools to solve one's problems and mastery of such techniques can make one competitive in many fields.

In the same forum Galway (profile/1043004) noted that mastery of mathematics has a sort of universal respect and that it is a communication language that transcends cultural, political and economic boundaries as well as the language of the universe.

Mook (profile/17457000) in the same forum, observed that all things in nature are based off of mathematical principles. He maintained that it is a great tool that is used absolutely everywhere, a tool for breaking down problems and for searching for their answers more especially in the field of science and technology.

According to Okafor and Anaduaka (2013), there is no half truth in mathematics as accuracy and expertness are the pillars on which mathematics stand.

Having noted the importance of mathematics in developmental purposes hence the need to utilize instructional materials for its teaching and learning, the questions that should arise are, are the mathematics Teacher-Trainers in these two colleges of education in Zamfara State actually having the knowledge of how the instructional materials within their jurisdiction can be utilized for effective teaching/learning mathematics? Below is a table showing the number and percentages of mathematics educators in the two colleges of education in Zamfara State involved in this write up.

Table 2. The number and percentage of the participating Mathematics Teacher-Trainers' in Zamfara State Colleges of Education

College	No. of Mathematics Educators	Percentage	No. that participated	Percentage
F.C.E.(T) Gusau	09	100	09	100
C.O.E. Maru	07	100	06	85.72
Total	16	100	15	93.75

Source: Mathematics Head of Departments' of (F.C.E.T.) Gusau and C.O.E. Maru. Staff Lists.

Table 2. shows that there are nine (09) Mathematics Teacher-Trainers' in Mathematics Department of Federal College of Education (Technical) (F.C.E.T) Gusau and all of them (100%) participated and completed the questionnaire used in getting the information used in writing this paper while there are seven (07) Mathematics Teacher-Trainers' in the State owned College of Education Maru and only six (06) 100% of them participated and completed the questionnaire. A total number of fifteen (15) 93.75% of the Mathematics Educators' therefore participated in the writing of this paper.

According to National Commission for Colleges of Education (N.C.C.E) (2009) Minimum Standard, a document that spelt out the activities and the requirements of all the colleges of education in Nigeria, the instructional materials, equipment and consumables expected to be made available in the Mathematics Laboratory/Workshop of each of the colleges of Education in Nigeria are as shown in table 3 below.

**Instruction Materials for Mathematics Laboratories/ Workshops in Colleges of Education in Nigeria**

Table 3. Instructional materials meant for the Mathematics Laboratories/ Workshops in the two Colleges of Education in Zamfara State [(F.C.E.T) Gusau and C.O.E. Maru].

S/No.	Item description	Quantity Required
	<b>INSTRUCTIONAL MATERIALS FOR THE (LABORATORIES</b>	
1.	Mini micro computers	One computer to ten students
2.	An Overhead projector	1
3.	Multimedia projectors	
	<b>EQUIPMENT FOR MATHEMATICS WORKSHOPS</b>	
1.	Work benches	4
2.	Vice	4
3.	Drilling machine (manual &electric	4
4.	Drill bit (various sizes)	4 sets
5.	Hand saw (various sizes)	6
6.	Solid shapes (cube, cuboid, cylinders, prisims etc	5 each
7.	Engraving machine	2
8.	Cutting knives	4
9.	Hammer (different sizes)	4
10.	Screwdrivers	6
11.	Mathematical sets (including blackboard sizes)	20
12.	Weighing scales	5 sets
13.	Scientific calculators	5
14.	Scissors (different sizes)	10
15.	Pinchers'	4
16.	Jack and plane	4
17.	Electric Organizers	4
	<b>CONSUMABLES FOR MATHEMATICS WORKSHOPS</b>	
1	Cardboard papers	1 realm
2	Binding wire	5
3	Plywood (assorted	10 sheets
4	Glue (wood)	5
5	Gum (liquid)	5
6	Celotapes	5
7	Metal sheets	5
8	Transparencies	5
9	Nails ( assorted sizes)	As required
10	Graph sheets	20
11	Beads (assorted sizes and colors)	20
12	Thread etc	2 rolls

Source: N.C.C.E. Minimum Standard for Colleges of Education in Nigeria.

Having seen the list of the instructional materials meant for the Mathematics Laboratories/Workshops in the two colleges, there is need to find out from the mathematics lecturers whether these items are supplied or not. There is



also need to find out how much of these items they can comfortably use during their classroom instructions. These questions are addressed as shown below.

Question 1. Are the instructional materials indicated in the list given to you which are meant for your Mathematics Laboratories/Workshops made available? If they are supplied please tick the word "available" otherwise tick the word "not available".

### Availability of the Instructional Materials

Table 4. Frequency and % ratings of the responses of Mathematics Teacher –Trainers' on the availability of the instructional materials, in the two colleges Mathematics Laboratories,/Workshops.

F.C.E. (T) Gusau

C.O.E. Maru

S/No	Items Description	Available	%	Not available	%	Decision	Available	%	Not available	%	Decision
	<b>INSTRUCTIONAL MATERIALS FOR MATHS LABORATORY</b>										
1	Mini micro computers	0	0	09	100	not available	0	0	06	100	not available
2	Overhead projector	0	0	09	100	not available	0	0	06	100	not available
3	Multimedia projectors	0	0	09	100	not available	0	0	06	100	not available
<b>EQUIPMENT FOR MATHS WORKSHOP</b>											
1	Work benches	09	100	0	0	available	06	100	0	0	Available
2	Vice	0	0	09	100	not available	06	100	0	0	Available
3	Drilling machine	09	100	0	0	available	0	0	06	100	not available
4	Drill bit	09	100	0	0	available	0	0	06	100	Not available
5	Hand saw	09	100	0	0	available	06	100	0	0	Available
6	Solid shapes	09	100	0	0	available	06	100	0	0	Available
7	Engraving machine	09	100	0	0	available	06	100	0	0	Available
8	Cutting knives	09	100	0	0	available	06	100	0	0	Available
9	Hammer	09	100	0	0	available	06	100	0	0	Available
10	Screwdrivers	09	100	0	0	available	06	100	0	0	Available
11	Mathematical sets (assorted)	09	100	0	0	available	06	100	0	0	Available
12	Weighing scales	09	100	0	0	available	06	100	0	0	Available
13	Scientific calculators	09	100	0	0	available	06	100	0	0	available
14	Scissors	09	100	0	0	available	06	100	0	0	Available
15	Pinchers	09	100	0	0	available	06	100	0	0	Available
16	Jack / plane	09	100	0	0	available	06	100	0	0	Available
17	Electric Organizers	09	100	0	0	available	0	0	06	100	Available
<b>CONSUMABLES FOR MATHS WORKSHOP</b>											
1	Cardboard sheets	09	100	0	0	available	06	100	0	0	Available
2	Plywood (assorted)	09	100	0	0	available	06	100	0	0	Available
3	Binding wire	09	100	0	0	available	0	0	06	100	not available

4	Glue (wood)	09	100	0	0	available	06	100	0	0	Available
5	Gum (liquid)	09	100	0	0	available	06	100	0	0	Available
6	Collotypes	09	100	0	0	available	06	100	0	0	Available
7	Metal sheets	09	100	0	0	available	06	100	0	0	Available
8	Transparen- Ces	0	0	09	100	not available	0	0	06	100	not available
9	Graph sheets	09	100	0	0	available	06	100	0	0	Available
10	Beads (assorted)	0	0	09	100	not available	06	100	0	0	Available
12	Thread etc	09	100	0	0	available	06	100	0	0	Available

Source: N.C.C.E. Minimum Standard for Colleges of Education in Nigeria.

From Table 4, the responses of the mathematics educators from the two colleges, show that none of the instructional materials (mini micro computers, Overhead projectors or multimedia projectors) meant for the Mathematics Laboratories in the two colleges were supplied. The Mathematics Laboratories were even conspicuously absent. The Mathematics Workshops of the two colleges were in existence but most of the equipment more especially those of College of Education Maru were not supplied. It is only the less expensive ones (work benches, Handsaw, solid shapes, Cutting knives, Hammer, Screwdrivers, mathematical sets, weighing scales, scientific calculators, pinchers, Jack and plane) that were fully supplied to both Colleges. F.C.E.(T) Gusau has more of the more expensive ones' supplied to her Mathematics Workshop than College of Education Maru which is state owned. The items supplied to ( F.C.E.(T) Gusau Mathematics Workshops but not to that of (C.O.E.) Maru are Drilling machine, Drill bit, Binding wire, Electric Organizers and engraving machine. Those supplied to C.O.E. Maru's Mathematics Workshop but not to that of F.C.E.(T) Gusau are Vice, Transparences and Beads.

#### Mathematics Educators responses to the questionnaire

Question 2 .Do you have the knowledge of how to utilize the instructional materials which are supposed to be made available in your Mathematics Laboratory for your classroom instructions? Please tick either "yes" or "No" against the options you selected.

Table 5.Frequency and % ratings of the Mathematics Educators' responses on whether they have the knowledge of how to utilize the instructional materials (technologies) which are supposed to be supplied to their mathematics Laboratories for effective classroom instructions.

S/No.	College	Freq. Yes	%	Freq. No	%
1	F.C.E. (T) Gusau	0	0	09	100
2	C.O.E. Maru	0	0	06	100

Source: Lecturers' questionnaire.

Table 5.shows that none of the mathematics lecturers has the knowledge of how to utilize the instructional materials meant for Mathematics Laboratories for the delivery of their lessons since the frequency of those who said Yes is zero with zero % and frequency of those who said No is nine (09) with 100% for F.C.E. (T) Gusau and six (06) which is also 100% for C.O.E. Maru.

Question 3.Do you have the knowledge of how to utilize all the equipment and consumables meant for your Mathematics Workshops for adequate preparation of your Pre-service Teachers in the art of making their own instructional materials?. Please tick where appropriate "yes (all), if you can utilize all the equipment and consumables adequately and when appropriate for your classroom mathematics instructions, and "yes some", if you can utilize only some of them and "No", if you do not know how to use any of them for your class room instructions.

Table 6.Frequency and % ratings of the Mathematics Lectures responses on whether they have the knowledge of how to utilize all the equipment and consumables which are supposed to be supplied to their Mathematics Workshops for adequate preparation of their Pre- Service Teachers'.

S/No.	College	Freq. yes (all)	%	Freq. yes (some)	%	Freq. No.	%
1.	F.C.E. (T) Gusau	0	0	09	100	0	0
2.	C.O.E. Maru	0	0	06	100	0	0

Source: Teacher- Trainers' questionnaire.

From table 6, it could be seen that none of the Mathematics Lecturers have the knowledge of how to utilize all the available equipment and consumables while delivering their lessons. The entire staff, fifteen (15) of them, claimed they only know how to make use of some of them for their class room lesson delivery. 0% claimed they cannot deny having knowledge of how to utilize any of the equipment and consumables neither can they claim having the knowledge of how to make use of all of them while delivering their lessons at any point in time.

Question 4. On the list of the equipment and consumables given to you

Question 5. If the response to question two (2) and three (3) above is yes, did you acquire the knowledge through any workshop (s) organized by any of the bodies listed below, aimed at teaching the Teacher-Trainers how to make use of these items in grooming their Pre-Service Teachers' in the art of making their own instructional materials?

The items ticked under equipment by the respondents were: Vice, Drilling machines, Drill bit, Jack and plane, Engraving machines and Electric Organizers while the ones ticked under consumables were: Binding Wire, Metal sheets, Plywood and Transparencies. listed below, aimed at teaching the Teacher-Trainers how to make use of these items in grooming their Pre-Service Teachers' in the art of making their own instructional materials?

- a) National Commission for Colleges of Education (N.C.C.E.).
- b) The College Authorities.
- c) Any other specified workshop.
- d) Self effort.

None of the respondents' ticked any of the above options. This implies that neither N.C.C.E. nor the college authorities organized any workshop to teach the mathematics educators how to make use of these items for effective delivery of their class room instructions. The Mathematics Lecturers' themselves did not make any effort to learn how to use these items through any other means for effective delivery of their lessons despite the fact that the lecturers' from School of Technical Education, which is one of the schools in F.C.E.(T) Gusau can assist in teaching the mathematics lectures' how to handle some if not all the equipment and consumables in their workshops.

## Discussion

As earlier discussed, Federal College of Education (Technical) Gusau was established in 1989 and College of Education Maru was established not less than fifteen (15) years ago, yet no attempt has been made to either find out whether the instructional materials, equipment and consumables meant for the Mathematics Laboratories/Workshops were supplied and are in good conditions or to find out whether the mathematics lecturers who are meant to frequently utilize them for effective classroom instructions are actually using them or not. And if they are not using them what could be the hindrances to their lack of uses? This investigation is very necessary particularly now that Nigeria is very much interested in achieving the objectives of the Millennium Development Goals (MDGs) and (NEEDS) Programs. From tables 5 and 6, it would be seen that most of the Teacher- Trainers' in the two colleges of education do not have the knowledge of how these instructional aides are being utilized for effective teaching and learning of mathematics since the response of those who claimed they can confidently utilize all the items are zero percent (0%), those who claimed they can only confidently utilize some of the equipment and consumables are nine (09) and six (06) which is 100% respectively for both colleges, while those who said they cannot effectively utilize any of them for classroom instructions are nine (09) and six (06) 100% for both colleges in the case of Mathematics Laboratories items. When they were asked to tick the ones they do not have the knowledge of how to utilize them for classroom instructions they ticked drilling machines, drill bit, hand saw, engraving machine, electronic organizers, jack and plane, ply wood, metal sheets and transparencies'. Mathematics instructional materials called "RABOMETER" supplied by (N.C.C.E.) since the 1990s has been lying idle in mathematics workshop of F.C.E. (T) Gusau. None of the mathematics lecturers has an idea of how to use them for mathematics instructions. Some of the equipment and consumables in these colleges are just lying waste and are at the mercy of rats, lizards, termites etc in the workshops. This shows the need to train the Teacher-Trainers in the art of effective and adequate use of teaching aides while in the training colleges and also supplement this with workshops to enable them sufficiently prepare the pre-service teachers who seriously need this knowledge for satisfactory performance of the task ahead of them when they graduate from their various colleges. It would also help to prepare them to study mathematics at higher levels.

In line with this, Leyola (2015) asserted that instructional materials are not chosen for the sake of using resources in the classroom instruction, but should be chosen and utilized appropriately so as to facilitate the effective learning acquisitions of the students'. Kedzera (2006) stressed that "not only instructional materials that are important but also how they are utilized that improves learning and increases pupils' interest". He further noted that teachers in frequent use of higher – order instructional technologies such as overhead projectors, multimedia projectors, computers, videos etc was as a result of lack of training and availability of the materials. He therefore suggested that constant training and peer- support are very important lessons to be learned by Teacher- Training Colleges. In order words Teacher- Training Colleges and other subject lecturers' are advised to work collaboratively in order to maximize the use of instructional materials, equipment and consumables in teaching and learning process for the prospective teachers'. If peer support had existed between and within these two colleges, the mathematics lecturers' of both colleges would have mastered how to use most of these equipment and consumables from lecturers in the school of Technical Education which is one of the schools in F.C.E. (T) Gusau and who on regular basis use some, if not all these equipment and consumables in teaching their pre-service teachers'. Diamini (1995) equally emphasized that the delivery of instructional materials should always be accompanied by teacher training on the on the use of the materials because the delivery of instructional materials in the classroom does not necessarily lead to their effective use by teachers'. He continued that the way most teachers' present instructional materials while teaching deprive them of opportunities of development in curriculum management hence stressed that there is need for advanced training of teachers' in the use of instructional materials. It is therefore of paramount importance that the supply of instructional materials to Teacher-Training Colleges should immediately be followed with training on the use of these materials if the desired objectives of using them for classroom instructions are to be achieved.

### **Recommendation**

In order to ensure that the mathematics instructional materials, equipment and consumables recommended by the National Commission for Colleges of Education (N.C.C.E.) in Nigeria for all Colleges of Education in the country are supplied and are effectively and adequately utilized by the Teacher-Trainers', the following recommendations have been advanced.

There should be constant monitoring and evaluation of instructional materials claimed to have been supplied to all the schools more especially Mathematics Departments of all the colleges of education in Nigeria.

Peer-support should be highly encouraged among schools more especially colleges of education in the country. This will not only help in transfer of learning but would also help to bring collaboration and peaceful co existence among the various institutions in the state as an adage has it that "no one man can become an island".

Frequent organization of workshops is essential so that with the help of instructional materials, the Mathematics Teacher-Trainers' can further be exposed to the present realities and challenges posed by this modern world of science and technology, which they would in turn hand over to their pre-service teachers'.

Teacher Training Colleges should endeavor to train their pre service teachers' well in the art of using instructional materials as well as in the art of making their own instructional materials (improvisation) using the provided equipment and consumables in their Mathematics Workshops for use during their teaching practice exercises and even when they might have graduated from their various Colleges and are teaching at the lower levels of education.

### **Conclusion**

This paper has emphasized that there is need to make sure all the mathematics instructional materials, equipment and consumables meant for colleges of education in Nigeria and particularly those of the two colleges of education in Zamfara state (an educationally backward state) in particular are fully supplied. It added that the items supplied should be coupled with trainings to enable the Mathematics Teacher-Trainers utilize them fully and effectively during their classroom instructions. It further stressed that when this is done, the Pre-Service Teachers' would be capable of using these items themselves and would equally be able to use the equipment and consumables in their workshops to make improvisation of the mathematics teaching aides they would require for their teaching practice and for use when they become permanent teachers' at the basic and senior secondary school levels. It noted that supplying some of these items and abandoning them in the workshops to be ravaged by rats, termites, lizards etc is not the best. The paper highly emphasized the need for peer support and collaboration amongst staff of various institutions of learning as well as among the staff of same institution for easy transfer of learning. The paper was concluded by stating that it is only when the mathematics educators are taught how to utilize these items and they fail to either utilize them or use them inappropriately or ineffectively that they can be penalized.

This paper recommends that when these Teacher Trainers have been trained in the art of efficient use of the instructional materials, equipment and consumables (when fully supplied), the next exercise should be to test the lectures competency level in the utility of these items for effective mathematics classroom delivery.

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