

## Achievement of Mathematics Teachers on Production of Computer Based Software Package for Teaching And Learning of Mathematics

Udobia Elijah Etukudo<sup>1✉</sup>

<sup>1</sup>*Federal College of Education (Technical), Omoku, Rivers State, Nigeria*

✉ email: [udobiaetukudo@gmail.com](mailto:udobiaetukudo@gmail.com)

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**Abstract:** The research was carried out to determine the achievement of mathematics teachers in the production of computer-based software packages for teaching and learning mathematics. Fifty (50) mathematics teachers of which twenty (20) were from primary schools, fifteen (15) were from secondary schools, and fifteen (15) were lecturers from tertiary institutions, were selected for this study. They were trained on computer-based software package production for twenty-one (21) days and rated. The result of the analysis using ANOVA and t-test at 0.05 level of significance, shows that there was no significant difference in achievement of the teacher in computer-based software package production. Primary school teachers had a mean achievement score of 73%, secondary 72%, and lecturers 75%. Males had 75.6%, females 71.5%, so, t-ratio showed no gender difference at 0.05 level of significance. It is recommended that computer-based software production by teachers should be encouraged.

**Keywords:** Mathematics; Teachers; Computer-Based Software Package; Production; Training.

### A. Introduction

It has become obvious that the use of computer in teaching and learning have contributed immensely to alleviate the problem of understanding and mastery. Computer has played a huge role in making learning easy. Teachers who have been able to lay hand on adequate and suitable software for teacher always find it easy to communicate the institutional content to learners in such a way that they attend mastery with ease. The joy of a good teacher is in having desirable result. This is made possible with use of computer. Rouse (2022) emphasized that computer based learning has many benefits such as help users to learn at their own pace, being very interactive, learning at one desired time, having that which is globally accepted and having the ability to accommodate traditional method. Rouse (2022) stated that knowledge-based training and assessments, simulation and drill are effected prudently with the use of computer. This make the use of computer in teaching and learning very relevant (Ingram, 1985). Computer software package was developed and used in teaching English Language and it was discovered that the product was easy to duplicate, contains elaborate learning material, pictures and displace design which make the students more enthusiastic and interested, while the exercises were more fascinating (Rohmar, 2019). The use of computer in teaching has helped to remove the complexity in instructional delivery (Garba, Umar and Hu, 2010, Vann, Mernenboer, 2002)

The most serious obstacles to the implementation of computer assisted instruction in the school systems include non-availability of facilities and lack of affordable and relevant software packages. The relevant package to use and carry out instructional delivery are scarce. There are several models that have been presented to be used in the development of computer-

based instructional packages. Rosenthal (1976) presented a model that contained segments and phases of instruction which includes administration and coordination, development of project team, definition of project scope and objectives, development of program for system design and conducting of orientation meeting. Evaluating this model before implementing computer-based instruction makes it look Herculean. Chen and Shen (1989) cited “waterfall models as the key to help make the software adaptable to users and satisfy their need. Similarly, Pappas (2014) instructed that production of computer-based software package has been the bends in computer based instructional delivery. Dulia and Muchtar (2019) enunciated the advantages of computer assisted instruction and proposed the use of a conceptual model which comprises introduction, presentation of information, question and responses, feedbacks, question and responses, feedback and responses, judging and responses, remedial, case exercise and finally closing.

Software has been developed with various languages for teaching and learning but the process seems complex and clumsy which makes it difficult for spread and effective usage hence some of the packages are short life. Software developed by Beitez (2018), Garbrar and Hu (2010), Michael and Igenewari (2022) has exciting results but were produced with peculiarity for specific instruction and cannot be generally applied or used in wider perspectives.

This lapses make it obvious that there should be a need to produce software that can be applied in all areas when need arises. It has become pertinent that teachers should know how to produce software for the instructional usage. It cannot be anticipated that instructional software can be sourced from market for every topic that are to be taught.

This study is carried to train mathematics teachers on the production of instructional software using reality model. The reality model provides direction which the teachers can always follow to produce software as much as they chose to and in every topic the need to use.

The major problem that hampered the proper implementation of computer-based instructional delivery in mathematics is the availability of relevant software at affordable cost. Though the use of computer in teaching mathematics at all levels has been accepted as a necessary breakthrough in the fields of educational development, it has not been possible to be widely applied due to the fact that the mathematics teacher lack the skills to use the packages and also relevant packages are not available in all the topics, therefore the study trained the mathematics teachers to produce the software packages themselves. Their achievement in the production of the packages are evaluated and correction given. This will give the mathematics teachers the skills and adept of production of computer-based software that are relevant to the topics in the scheme of work and syllabi.

The study will make computer-based instructional packages that relevant to the scheme and syllabi readily available for use in teaching mathematics at all levels of education and as a result lead to improvement in students' achievement and general learning outcome in mathematics. Other subjects, courses and disciplines will also benefit if they will join the mathematics teachers.

Considering that computer-based software has huge positive impact on teaching and learning and general instructional delivery when it is applied, it becomes necessary that the product should be available for teacher and learner as at any time there is need to apply. This cannot be except the teachers can produce the software for their usage and that of the learners.

The achievement of mathematics teachers in software production using reality model is evaluated and reported in this study. It has positive and promising result.

The relevance and essence of computer in teaching and learning has been enunciated by several researchers but getting the relevant packages for implementation of the computer assisted instruction when needed has always been the clog in the wheel of progress of the usage of computer-based packages in teaching and learning. This paper is aim at alleviating the problems associated with the production of instructional software for teaching and learning of mathematics by training mathematics teachers for production of software that can readily be used for that purpose. It prepares mathematics teacher for the production of software which can be used in the teaching of mathematics. In other words, it promotes software improvisation. The teachers are trained to write program that can run for the purpose of utilization in mathematics classroom. The achievement of the teachers and their programs are reported in this paper.

## **B. Methods**

The study is an experiment which was carried out with mathematics teachers in primary schools, secondary schools and tertiary institutions in Rivers State of Nigeria. They were purposively selected for the study on the bases of their willingness to participate, to be trained and their achievement in production of computer-based software for teaching mathematics using BASIC and python programming languages evaluated.

### **1. Population of Study**

The population of the study include all mathematics teachers in the public and private institutions (schools) in Rivers State of Nigeria. The selection includes primary school teachers, secondary school teachers, lecturers in College of Education, Polytechnics and Universities. The population of study cut across all the mathematics teachers teaching at primary schools, secondary schools and tertiary institution in the State. A total of 2,575 mathematics teachers made up the population.

### **2. Sampling technique**

Positively random sampling procedure was used for the study. The participant were selected on the order of first come first serve. The teachers who responded to the invitation early and accepted to participate in the three weeks training were the one that were chosen.

### **3. Participant**

Fifty (50) mathematics teachers participated in the study. They were thirty (30) males and twenty (20) female mathematics teachers. Twenty (20) teachers were invited from primary schools, fifteen (15) from secondary schools and tertiary institutions. There was no criteria for the selection. The teachers were used for the study based on their willingness to participate. The number of participants was restricted to 50 based on first come first serve order. The fact is that those who accepted the invitation early were the ones that were used. The reason for selecting only fifty participants was because it was training based. They were taught and evaluated for a period of three weeks hence only one stream of the participants was used for the purpose of perfection and good management. They were all trained in the Federal College of Education (Technical), Omoku, Computer laboratory. Among the participants were twenty (20) female and thirty (30) male mathematics teachers.

#### **4. Instrumentation**

The instruments used in the study includes

- (1) Training manual
- (2) Program packages
- (3) Participant involvement checklist
- (4) Training checklist
- (5) Participants trial test items
- (6) Participant assessment checklist

#### **5. Training manual**

This is a set of rule for the training. It states categorically the time each aspect as the training takes place. The introduction takes about ten (10) minutes. Familiarization with computer and master of the keyboards twenty (20) minutes introduction to programming. Thirty (30) minutes interaction with the programmers and the technicians. thirty minutes and practical exercise, thirty (30) minute. This formed the two hours training for the first day.

The second day of the training was on introduction to BASIC programming. Which the participants were taught how to write BASIC programming language. The question and answer session was on the different technicalities of writing BASIC programming and producing software with it. The practical session was also included for forty-five minutes. The session end with correction of trainees programs and assignment.

The third day continued with BASIC programming. The technical session was one hour while the practical session was one hour which ended with correction of trainees programs and assignments.

Day four was rehearsal of BASIC programming and package production with BASIC.

The fifth day, day five was introduction to python programming. It was one hour theoretical and practical work was for one hour. The ended with assignment on python programming language.

The sixth day, day six was practical programming with python which took one hour forty-five minutes, with exception of the fifteen minutes of introduction, it ended with assignment.

The seventh day, day seven was animation programming. One-hour introduction and theoretical work on animation and another one hour was practical programming and production of two dimension and three-dimension objects.

The eighth day was mixed with program packages writing. Programing packages with BASIC and python while the ninth day was introduction to mathematics program packages production sample packages.

The tenth day was practical package production using topics from the scheme of work. The eleventh day was trial package validation while the twelfth day was implementation of the trial package. The package was short instruction produced by the teachers. The thirteen and fourteen day were for revision. The third week was practical implementation of the packages, marking of pre and posttest of students taught with the trial packages and collection of results on the achievement of the participant as well as closing of the training workshop.

#### **6. Program packages**

The training instructions were package in BASIC and python. They were delivered through local area network (LAN) to the different computer which the trainees were using with

screen and multimedia facility used for explanations and interactions. The packages were properly validated. Other programming packaging in mathematics instructions at the three levels of education were also shown and used as examples for discussion.

### 7. Trainees’ involvement and commitment checklist

The checklist contains the rating of activities of the trainees during the lesson. It was presented as in the table below, for each of the participants. The rating was done by technicians and research assistants.

**Table 1. Participants checklist**

S/N	ITEMS	1-10	11-20	21-30	31-40	41-50
1.	Punctuality					
2.	Attentiveness					
3.	Contributions					
4.	Asking questions					
5.	Answered questions					
6.	Ability to use computer					
7.	Ability to write codes					
8.	Ability to interpret codes					
9.	Logical production of ideas					
10.	Good program package on chosen topic					

The above was the individual checklist for each of the participants during learning.

### 8. Training Checklist

This is a general checklist that was used to monitor the rate which the training was progressing and serving each aspect that was required.

**Table 2. Training Checklist**

S/N	ITEMS	1	2	3	4	5	6	7	8	9	10
1.	Proper introduction										
2.	Proper using of package										
3.	Relevance to trainees need										
4.	Carrying trainees along										
5.	Helping the trainees to mastery concepts										
6.	Enabling the trainees to meet objectives										
7.	Trainees able to produce packages										
8.	Trainees package meeting the objectives										
9.	Adequacy of trainees packages										
10.	Learners learning outcome improvement with trained package										

### 9. Participant Trial Test Items

This comprised of the pre-test and posttest items which the trainees used to implement their packages. They were set on the topic which their packages were produced and administered before and after their experiments.

### 10. Participant Achievement Checklist

This is where items which the participants were scored were evaluated.

**Table 3. Participant Achievement Checklist**

S/N	ITEMS	1	2	3	4	5	6	7	8	9	10
1.	Involvement in the training										
2.	Ability to write program										
3.	Production of workable package										
4.	Relevant of package to the object to the topics										

S/N	ITEMS	1	2	3	4	5	6	7	8	9	10
5.	Acceptance of the package by learners										
6.	Achievement of objectives through the package										
7.	Proper usage of the package										
8.	Evaluation of the objective via the package										
9.	General assessment of the trainee product										
10.	Learners assessment of trainees product										

### 11. Research Procedure

The research was carried by giving invitation to all the mathematics teachers in the state. The fifty (50) participant were selected from the list of those who responded to the invitation in the order of first come first serve. The training was carried out in the computer laboratory of the Federal College of Education (Technical) with the help of two programmers and four technicians and five other research assistants. The trainees were taught how to produce computer-based instructional packages in mathematics.

After the teaching, they produced their packages and test run them. Their packages were in different topics in mathematics taught at the level which they were teaching. They used the packages to evaluate their learners learning outcomes to determine the success of the training. They were evaluated using the checklist. The data were collected using the checklists.

### 12. Training Model

The efficiency skewed four prompt model encompasses four key agents that drive the activities namely: instruction, programmer, teachers and learners, was used for the study.

The instructional contents were first examined by both the teacher and the programmer, then the nature of the software package was decided by flowcharting the component and processes. It from here that the programming language or languages were chosen. Thereafter the instructional content, the subject matter that will be presented were keyed into the package. Flexibility, adaptability, suitability (relevance), acceptability (meeting the learners needs), adequacy and durability of the packages were considered as very important elements of functional ability of the packages. The packages were exposed to learners’ appraisal in order to seek their satisfaction in trail with a smaller group, a smaller group of the contemporaries which the package is produced for. It is at this point the package can be considered efficient. This give rise to “efficiency skewed four prompt model” for production of computer-based package for teaching and learning mathematics.

The training was done based on “efficiency skewed four prompt model” termed REALITY MODEL given below

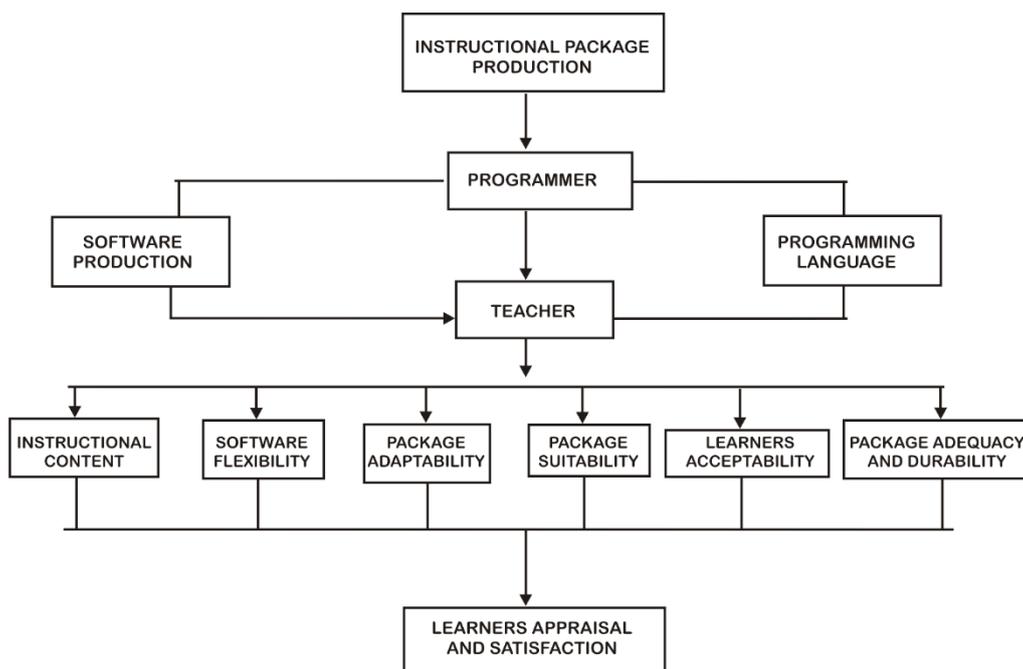


Figure 1. Efficiency Skewed Four Prompt Model

### C. Results and Discussion

The hypotheses were tested using Analysis of Variance (ANOVA) with Scheffe’ correction for the difference between groups while t-test were used to determine difference between genders. All the hypotheses were tested at 0.05 level of significance.

#### 1. Hypothesis I

There is no significant difference in the achievement of mathematics teachers in the production of computer-based software for teaching and learning mathematics.

The result of data analysis is given in the ANOVA table, Table IV below.

Table 4. ANOVA Table for Achievement of Mathematics Teachers on the Production of Computer-Based Software Package for Teaching and Learning Mathematics

Source of Variation	Sum of Square	Degree of Freedom	Mean Square	F	Decision
Between	70.5	2	35.25	0.75	Accept
Within	2,112	47	46.93		
<b>Total</b>	<b>2,182.5</b>				

The critical value for  $F^2_{47} = 3.23$  which is higher than the calculated value 0.75

With a mean achievement score of 73% for twenty (20) primary school mathematics teachers 72% for fifteen mathematics in secondary schools teachers and 75% for fifteen (15) lecturers from tertiary institutions and calculated value of  $F^2_{47} = 0.75 < 3.25$  which is the critical value, this shows that there is no significant difference in the achievement of mathematics teachers in production of computer-based packages for teaching and learning mathematics, testing at 0.05 level of significance. Hence hypothesis I is accepted.

#### 2. Hypothesis II

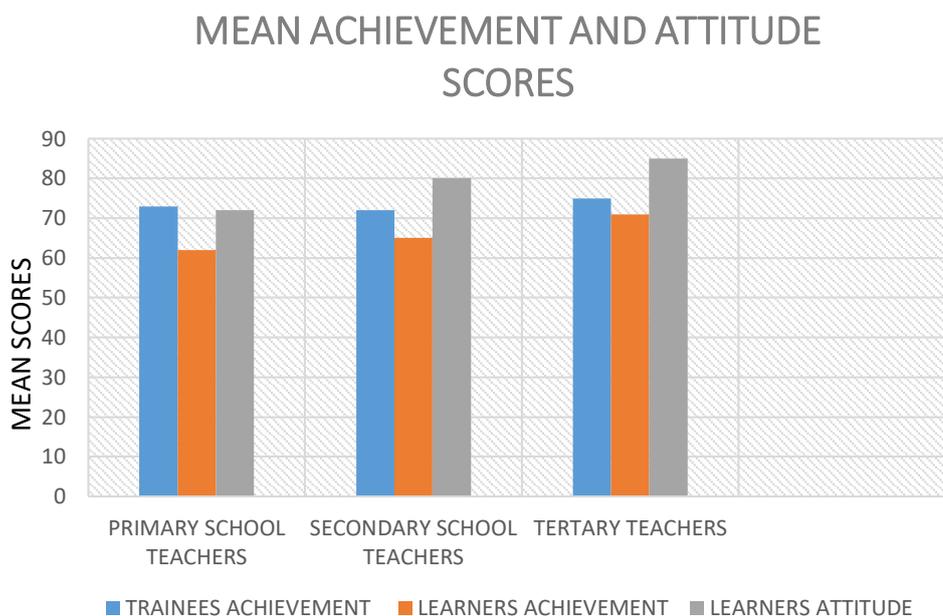
There is no significant gender difference in the achievement of mathematics teacher in the production of computer-based packages for teaching and learning mathematics.

The result of data analysis is shown in Table V below.

**Table 5. t-ratio of the achievement of mathematics teachers in production of computer-based software package for teaching and learning mathematics.**

Gender	Number N	Mean $\bar{x}$	Standard Deviation	Degree of Freedom	t-ratio	Critical Value	Decision
Male	30	75.6	20.32	48	0.63	2.02	Accept
Female	20	71.5	24.68				

The result of the data analysis presented in the Table V above shows that there is no significant gender difference in the achievement of mathematics teacher in production of computer-based software for teaching and learning mathematics. Hence hypothesis II is accepted. The calculated value of t-ratio,  $t = 0.63 < 2.02$  which is the critical value confirm the existence of no significant gender difference in the achievement.



**Figure 2: Achievement of trainees and the learning outcomes (achievement and attitude) of students taught with improved computer – based packages**

Figure 2 gives the man scores of the achievement of the trainees and that of the achievement and attitude of students used in package implementation.

### 3. Discussion

The main objective of this research is to reveal the possibility of making computer-based packages for the teaching and learning mathematics available everywhere and as at when needed, at the lowest cost or as cheap as possible, since computer-based software are seen to be adequate, essential and efficient in promoting quality delivery of instruction and learning with ease (Rouse, 2022; Michael and Igenewaru, 2022; Rohmar, 2019). The paper report a study which the researcher undertook to train mathematics teachers in the production of computer-based software packages on the topics in the curriculum or scheme of work which for the level which they are teaching. Fifty (50) mathematics teachers, included were twenty (20) from primary schools, fifteen (15) from secondary schools and fifteen (15) from tertiary institutions (lecturers), all teaching mathematics were used for the study. The result shows that there was no significant difference in their achievement in software production. All the participants were scored using a suitable checklist developed by the researcher and properly

validated by experts. The achievement and general learning outcome of the learners who benefitted from their trial software were also evaluated and were noted to improved admirably. All the participants recorded mean score of above seventy percent (70%) in the general achievement. The mean score of the primary school teachers was 73%, secondary school teachers 72% and lecturers 75%. The result of ANOVA, f - test at 0.05 level of significance showed that there was no significant difference in the achievement across the group.

The participant (trainers) comprised twenty (20) females and thirty (30) males mathematics teachers. There was need to examine whether there was comparably any significant gender difference in the achievement of the trainees using t-tests. The result showed there was no significant difference between the achievement of male and female participants. All the participants produced workable and efficient software packages which were used to harnessed good instructional delivery that were highly rated.

As a result, teacher produced computer-based software packaged should be encouraged by training the teachers to write programs for their use and that of their students and pupils so that they can learn effectively with the packages.

The research was carried out to determine the achievement of mathematics teachers in production of computer-based software package for teaching mathematics. The participant comprised of fifty (50) mathematics teachers who were trained for twenty-one (21) consecutive days without break. The result reveals that there was no significant difference in their achievement in the production of the computer-based packages for teaching and mathematics. All the participant had good scores. A mean achievement of 73% for 20 primary school teachers, 72% for 15 secondary school teachers and 75% for lecturers from tertiary institutions. This shows that all the participant has good scores. There was also no significant gender difference in achievement as the 20 female and 30 male mathematics teachers with mean score of 71.5% females as against 75.6% for males. The training of teachers for the production of software should be highly encouraged. The efficiency skewed four prompt model is a good source of guide for such training and package production.

## **D. Conclusion**

The preparation of teachers for production of computer-based software package for teaching and learning mathematics was the focus of this research. The result showed that there was no significant difference in the achievement of mathematics teachers in computer-based software package production across the three level of education – primary, secondary and tertiary. All the participant achieved above 70% mean scores. Both male and female mathematics teachers achievement in the computer-based software package production were high and was not significantly different. The use of efficiency skewed four prompt model enhance good result for training. Teacher made computer-based package should be encouraged.

Based on the findings this study it is recommended that:

- (1) Teachers should be trained on the production of computer-based software package for teaching and learning.
- (2) The training should be done by: (a) Teachers themselves involving computer programmers to help them, (b) School authorities sponsoring the teachers for the training,

- (c) The Government, (d) Community, (e) Donor agencies, (f) Philanthropist, (g) International organization like UNESCO
- (3) The use of teacher made computer software package should be encourage to reduce scarcity of software packages for effective teaching and learning.

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