Enhancing Effective Teaching and Learning Using Multimedia Tutorials with Quizzes on Smartphones

Fuseini Inusah[1*]   Dr. Alhassan Salamudeen[1]   Cornelius Kuufaar[2]
1. Department of Maths/ICT, Bagabaga College of Education, P.O Box 35 E/R, Tamale, Ghana
2. Department of Languages, Bagabaga College of Education, P.O Box 35 E/R, Tamale, Ghana

Abstract
The curriculum of colleges of education in Ghana emphasis on professional values and attitudes, professional knowledge and professional practice to help groom trainee teachers. This paper dwells much on the professional practice. With an averages student population of one thousand five hundred (1500), there is only one computer laboratory with only sixty (60) computers working in Bagabaga College of Education in the Northern Region of Ghana. This brings the average computer student ratio to 1:25. This inadequate computers in the school does not enhance effective teaching and learning thereby making teachers resort to lecture method in teaching practical lessons. The study is to help students in level 200 in Bagabaga College of Education learn practical task in ICT using their smartphones as a substitute for the computer. Five hundred and seven (507) students out of the total population of over one thousand five hundred (1500) students were used in this research as they constitute a year group for the study. Research instruments used are: test and observation. These were used at the pre-intervention and post intervention stages of the research. Multimedia tutorials was developed to assist the learners learn at their own pace in some of the practical tasks. Post intervention information revealed that students' performance improved significantly. Camtasia studio 7 was used in developing the tutorial with natural Ghanaian narrations by the tutor. The findings of the research revealed practical lessons that are taught by mere demonstrations without students practice do not enhance students understanding of the subject matter. Demonstration coupled with students practice are vital to student understanding of classroom lessons.
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1.0 Introduction

The Ghana Education Service in collaboration with the Curriculum Research and Development Division has structured the syllabus of the colleges of education to effectively train teachers to impart knowledge on pupils at the basic school level. Apart from imparting knowledge on the students, the curriculum will also help the teacher trainee to be more efficient in carrying out other duties as a teacher. Practical task in applications has been included in the syllabus to enable trainee teachers learn how to carryout practical task such as continuous assessment, report writing, calculation of figures, ranking of students after assessing them and sorting of data. These specific task were seen as difficult task for the students in Bagabaga College since they do not all get the chance to practice during lessons due to inadequate computers in the college's computer laboratory. These students however have smartphones that can run the Microsoft applications for them to practice.

The importance of practical task is well noticed in the Ghana Education Service. Almost all templates for data collection are design using Microsoft applications and the importance has been noticed by various stakeholders of education and information. This therefore makes stakeholders place so much emphasis on training and capacity building to help improve the efficiency of teachers in the service.

In 2015, the government of Ghana through the ministry of education in collaboration with the Ghana Education Service contracted the Rlg Institute of Technology to assist Government in boosting ICT education. Government at the time significantly improved Information Communication Technology (ICT) as a vital contribution to Ghanaian education system.

Rlg Institute of Technology was contracted by the Ministry of Education to train, develop and improve the ICT knowledge and skills of basic school teachers across the country. This was one of the projects under the Government's Basic School Computerization. The main goal of this training was to introduce ICT in the basic schools nationwide to help basic school pupils gain the requisite skills in ICT usage and also enhance effective teaching and learning. Over thirty one thousand (31,000) teachers were trained in this batch after a major training of that caliber was done in the year 2013. Mensou (2015)

Students in Bagabaga College of Education who are teacher trainees have difficulties in carrying out practical task due to the inadequate computers in the college for teaching and learning. This is due to lack of practice after class and the inadequate time allocated for practical lessons in schools. This problem makes students not being able to understand what they learn and cannot even revisit those topics on their own for better understanding. This research is therefore made to help identify and solve the problems students face in practical task by using their smartphones in place of the computer. It will also help students to learn on their own without

the guidance of the teacher by the help of multimedia tutorials.

Multimedia tutorials was chosen to help solve the problem of student's forgetfulness, their inability to use the computer to carryout practical task and the lack of practice after class.

The purpose of this study was to find out a sustainable solution to carrying out practical task even at remote areas by the use of the smartphone as an available ICT tool.

The following questions will be addressed by the research:

1. What will the use of tutorials and quizzes on smartphones and students practice in every practical lesson help students remember in practical lessons?
2. To what extent will quizzes after every lesson help student remember what they practice in class?
3. How will multimedia tutorials help students learn at their own pace in the absence of a teacher?

This research work is very relevant for addressing problems students face in remembering practical task. The study will also add up to relevant literature to assist stakeholders in Ghana during the implementation of ICT in education policies. Also, it will help the stakeholders in knowing the importance attached to the provision of computers to the teacher trainee in school to aid in the teaching and learning of ICT. The study will also help the learner to know the importance attached to "learning by doing" and the need to always go through practical sessions during classroom lessons. The multimedia tutorial product will be a source of reference for the teacher in the classroom to prepare adequately before going to teach.

The study examines the problems associated with abstract learning, inadequate practical lessons and the effect of inadequate computers in the laboratory for learning.

2. Literature Review
2.1 Multimedia
Computer usage and multimedia systems is one of the commonest technology. Burleson et.al (2001). Considers Multimedia system as a computer-based communication system. It comprises of text, audio, video, graphics and computer animations. Multimedia software is now becoming vital in modern learning process. Instructional software for different subjects is now available for different knowledge levels. Integrating classroom lectures and multimedia tutorials gives the theoretical foundations and also the visual component for the ICT challenges that help the learner to acquire the concepts and build their practical skills.

2.2 Tutorial
Tutorial is a technique of instruction used in learning process. There is more interactivity in tutorials than a book or traditional lecture. (Malik, 2012). It teaches by example and gives information to complete a task.
A tutorial can be in many forms, this ranges from instructions to complete a task to an interactive problem solving session sometimes with quizzes (usually in academia).

2.3 Multimedia Tutorials
Lawrence (2008) is also of the view that Multimedia is the use of many media elements to present information. Since these elements can be combined in a computer, computer based instructional technology is now the commonest. This software in the form of computer-based tutorials assist adults to the new category of learning called edutainment to assist children learn.

According to Malik (2012), Multimedia is being used increasingly to provide computer based instruction. One reason behind this may be the assumption that multimedia information helps people learn. Some cases in which multimedia information can assist in learning include; when the media supports dual coding of information, when the media support one another and when the media is presented to learners at their level of understanding. There is enough research evidence concluding that specific multimedia can be used to help people learn specific kinds of information.

2.3.1 Advantages of Multimedia Based Tutorials
Andresen (2013) opines that the advantages of multimedia tutorials over static non-interactive tutorials cannot be underrated in learning. The traditional system of tutorials that has to do with the use of written guide lines or procedures to help learners go through a task without going through interactions and demonstrations lacks the practical task that learners go through to acquire knowledge. Advantages of multimedia tutorials over the traditional tutorial system are;

1. The answering of questions after a test to find out one's level of understanding (quizzes).
2. The use of demonstrations and practical view also enhance learning in multimedia tutorials as compare to the traditional system of tutorials.
3. The combinations of text, voice, video and other forms of media arouses the interest of learners and keep them learning as it motivates them.
4. The grouping of task to various stages which can be selected for learning gives the learner the chance to start learning at a suitable stage.

5**.** Learners can learn at their own pace and also control the rate of leaning.

2.4 Practical Lessons
Practical lessons involves students observing or manipulating real objects or materials after witnessing a teacher demonstrating. This arouses the interest of learners. It makes learners acquire laboratory skills, improves the acquisition of scientific knowledge, give them understanding of scientific method and develop their expertise in acquiring scientific attitudes such as open-mindedness and objectivity.

Millar (2004) refers to practical lesson as "any teaching and learning activity which at some point involves the students in observing or manipulating the objects and materials they are studying". He preferred the term 'practical work' rather than 'laboratory work' because location is not a critical factor in grouping this kind of task. Observation or manipulation of objects might either take place in a school laboratory or occur outside the school environment, such as the student's home or in the field.

The British Science Community Representing Education or Score (2013) defined practical work in science education as "learning activities in which students observe, investigate and develop an understanding of the world around them, through direct, often hands-on, experience of phenomena"

2.4.1 Effects of Practical Work on Learners Understanding.
Zaid (2015) states that in addition to arousing students' interest, carefully planned practical lessons should achieve three main objectives: enhancing students' understanding, increasing practical skills in use of tools and devices and developing understanding of scientific enquiry

2.5 Camtasia Studio
Scott (2011) explained Camtasia studio as a software for creating and editing video, sound, graphics, text and other multimedia elements which was developed by Techsmith Company Limited. This multimedia company is the global leaders for screen recording and screen capturing software. Camtasia Studio really has two main functions: video editing, and screen casting (recording your computer screen). It is this combination of tools that makes the software an ideal solution for video creating and editing for the novice and expert.

Unlike Final Cut Pro or Adobe Premiere Pro which are specifically used by professionals, camtasia is easy to use and can be used by an average person. Camtasia Studio 7 offers a powerful yet simple option for video creation and editing. Figure 1 shows the interface of camtasia studio 7
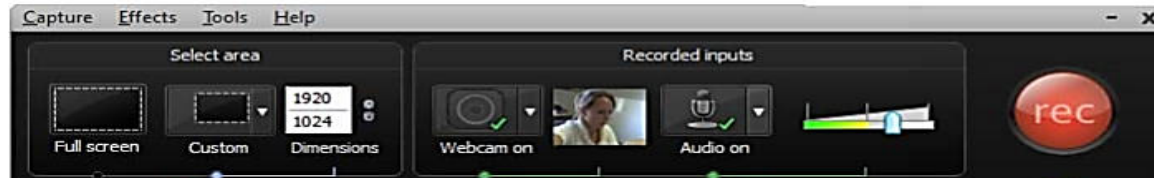

Figure 1: Interface of camtasia studio 7.
Source: www.camtasia.com online help version 7

2.6 Classroom Lecture versus Multimedia Instruction
Multimedia tutorials is a good learning tool (Poli et al, 2003). It can have all the necessary tools for an effective learning experience. Multimedia elements can easily be integrated in to achieve user friendliness and pleasant experience. Merino and Abel (2003) said tutorials can be used as a supplement for traditional classroom teaching. It can also be used as a single teaching tool for on-line courses or even for in-house courses. Effectiveness of multimedia has been proved as concluded.

Visual aids are recognized by many educators and researchers as can be seen in Juarez-Espinosa et al. (2000), Lowrie (2002), Les and Les (2003) among others. The lesson delivery in ICT laboratory is to expose the students to practical tuition and also assist students to solve problems. The well-known saying "graphics speak louder than words" is applicable in learning ICT. However, the use of computer laboratory for ICT is not only costly but also difficult to accomplish in some schools.

Computers and multimedia is the commonness in the learning environment of many learners. Multimedia system is seen as a computer-based interactivity system as defined by Burleson et.al (2001). It includes the use of multimedia elements. Multimedia software is now very vital in the learning process. Therefore, the combination of classroom lectures and multimedia tutorials gives a theoretical foundations and visual component for the ICT problems which assist the learner to acquire the concepts and enhance their retentive memory.

 Interactivity matters in student learning and evaluation of lesson is also very important to access the level of progress of the learners. It is therefore prudent for the problem to be tackled by using a more detailed and careful approach to help in getting a lasting solution to the problem.

It can be clearly seen from the above that, all the various aspects talk about tutorials as an alternative to classroom learning. However, they all fail to include quizzes and clear voice narrations with demonstrations to

help the learner understand the concept. This study is therefore in to the details of multimedia tutorial development to develop interactive multimedia tutorials with clear and natural voice narration to help the learners understand the concept. It also include quizzes at the end of each lesson to test the level of understanding of the learner.

2.7 Smartphones

Smartphones are the new digital mobile phones that have multiple functions similar to that of a digital personal computer. Apple's iPhone, techno android phones, Samsung smart phones etc. are the most popular example, with over 70% of students in the college own a smartphone. Almost every mobile phone you can buy now will have some sort of smartphone capability. Figure 2 shows picture of smart phones
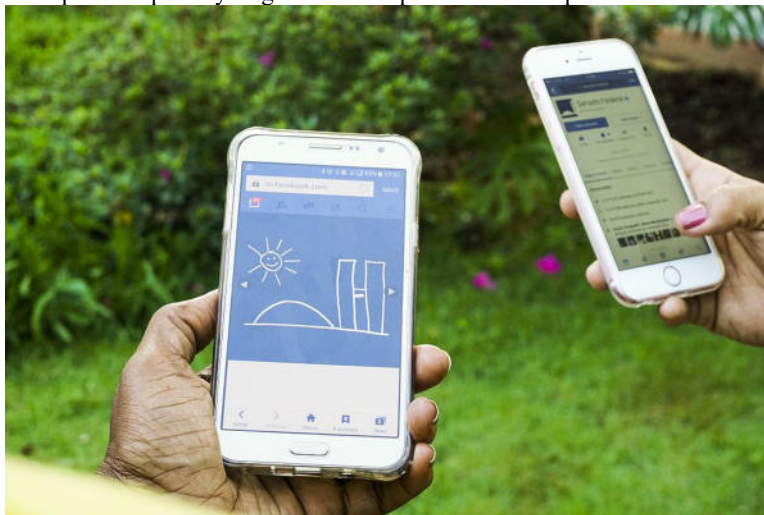

Fig 2: Picture of a smartphone

2.7.1 Smartphones' key benefits and features

Smartphones are about the same size, shape and weight as a normal mobile phone. They usually have a large amount of memory to store and carry music, photographs, videos and other larger information.

One can enjoy all internet services on a smartphone wherever you are, either through an internet bundle from your network service provider or through a Wi-Fi connection if available.

Smartphones have the ability to run applications known as 'apps' – computer programs that run on your phone. Apps can provide a wide range of functions, from word processors such as Microsoft word, data computation and analysis such as Excel, presentation software such as PowerPoint, to games and foreign language translators. This means one can have a fully functional computer in your pocket. The main function of every phone is to make calls and receive text messages. Smartphones can also make and receive phone calls and text messages.

Smartphone costs vary a great deal, according to model and functions. One needs GH₵ 200 or more to acquire a smartphone.

3. METHODOLOGY

The research design, populations, sample, sampling techniques, research instruments and data collection and data analysis for the research is discussed in this section.

The purpose of this study was to find out a sustainable solution to carrying out practical task even at remote areas by the use of the smartphone as an available ICT tool.

3.1 Research Design.

This research was carried out once in Bagabaga College of Education. The problem was identified and solved in the school at a duration of four months.

3.2 Population

The targeted group in this research was the level 200 students of Bagabaga College of Education made up of five hundred and seven (507) teacher trainees. The population is made up of over one thousand five hundred (1500) students who are from first year, second year and final year.

3.3 Sample

The sample of the research was made up of five hundred and seven (507) students from the population. This was a group given the tutorial to practice and their pre-intervention performance was compare to that of the post intervention performance. Sampling was based on the level 200 year group doing the practical courses in Microsoft office.

3.4 Sampling Techniques

The sampling technique that was used in the study is purposive sampling as the purpose was for a group of learners to grasp a learning concept.

3.5 Research Instruments

Observation and test are the instruments used in this research. Details of how each of these instruments was used are as follows.

3.5.1 Observation guide

This was another instrument that was used to gather data in other to find out the nature of the problem and the strategies to solve the problem. Under this, the respondents were observed in the research to find out the behavioral pattern they may possess that is likely to be affecting them in the problem. The result of the observation was use for interpretation to find out if the problem actually exists. It was also used at the post intervention stage to find out if the problem has been solved.

3.5.2 Test

A test was conducted to gather information about the performance of the students in practical task. This was used at both the pre-intervention and the post intervention stages to gather data for interpretation to the problem. It was made up of twenty (20) questions and each question was assign five (5) marks. This instrument was very reliable as the true reflection of students performance was recorded at each level.

3.6 Intervention, Design and Implementation.

This aspect talks about how preparations were done to tackle the problem and the various measures that were taken at each stage to ensure that the problem was addressed with ease. The Pre-Intervention, Intervention Design, Implementation of Intervention, Post Intervention and Discussion of the Study/Presentation of Findings and Results are the aspects looked at.

3.6.1 Pre- Intervention

Before solving the actual problem identified, the researcher used some measures to find out if the approach to the problem is the best strategy to adopt. The students' inability to carryout practical task was a problem that should carefully be looked at to get a better approach to helping the students do away with those challenges. The students were carefully observed during this stage.

Some of the factors that were identified are;

1. Students do not go through lessons practically hence they are passive listeners during lessons.

2. Students do not get the chance to practice what they learn after class because they do not have computers in their various halls of residence in the school.

3. There are no questions for students to answer to test their ability to perform certain task.

4. The number of students using the computer laboratory as well as the number of computers in the laboratory also affect the learning of the topic.

5. Students cannot get the guidance of the teacher to go through learning after classes which affects their understanding.

Based on these responses, the researcher settled on using Camtasia studio to develop multimedia tutorials to help the students understand and carryout practical task with higher efficiency. This approach reduced the challenges that the students were facing in practical lessons.

3.6.2 Intervention

After the main problems were identified and the approach to solving the problem was chosen, the researcher moved in to gather information on the approach chosen. Camtasia studio 7 was the software used to develop the multimedia tutorials and quizzes. The software has been selected among a lot because of the convenience and the interactivity features that makes it possible for students to go through all steps practically. The availability of quizzing in the software was another factor that stimulated the researcher to use the software for the development of the product.

The multimedia tutorial was developed by using the Camtasia Studio 7 software. Video recording of practical lessons was done with narrations and discussions. After discussing the various features in practical lessons, the main problem of the practical work were looked at in detail. Voice narration accompanied by the movement of the mouse pointer to go through practical work with vivid explanation of the procedure and the terminologies involved in each stage was the strategy adopted. The recording of the screen was captivating

enough to help student go through the tutorial with ease. After going through the various tabs with the groups or chunks under them, the researcher set questions from the topic to test student's level of understanding of the tutorials. Both multiple choice and short answers objective quizzing has been used in the tutorial to help students do self-test to find out their level of understanding of the topic. After answering each question in the test, a feedback is given to the student. This is to help students know as to whether their responses are correct or wrong. At each of the stages of the tutorial, students are also motivated to keep them learning. Chance is also given for students to select the stage they want to learn without going through unwanted stages.

3.6.3 Implementation of Intervention

The product was launched with the students to take them through how to use it. Each student was ask to give out any portable storage medium to copy the tutorial as a personal copy. The tutorial was also loaded on the school computers giving the students the chance to learn on their own anytime they have access to the computer laboratory without a teacher. The students were encouraged to keep watching the video as it will make them understand the concept well. The product can be played on any device that supports MP4 or MPEG, so those with smart phones can use it. Also, those with computers in their various homes will have more advantage as they can answer the questions through the quizzes for feedback to measure their level of understanding.

In all, the five hundred and seven (507) students had access to the multimedia tutorial and used it at their convenient time to enhance more understanding. The researcher took steps in finding out the level of progress of the students by testing them periodically to find out how far they are going with the tutorial. Students who were having problems in understanding some of the aspects in the video were given attention by the researcher to enable them pace well in the task.

3.7 Post Intervention

After the product was delivered to the students and they used it, the researcher took measures to find out if the students actually understand the teachings and can now face the challenges that they were facing with ease. Class test was conducted to find out students level of understanding. From the results gathered, it was clear that the students showed knowledge of the topic and were able to perform various tasks in the topic. The interest of the students in the learning of ICT was also aroused as they keep attending ICT classes voluntarily. The data and the results of the above stages are illustrated in the data analysis.

4. Data Analysis

The data was organized in tables and graphs. The main technique used in analyzing was frequency tables and percentages, since it appear to be more understandable. Also, paired sampled T-test was used to compare the pre intervention results to the post intervention results to find out the variation between them. Each of the results was also interpreted in the form of explanation to help in clarifications. This analysis was based under the research questions.

4.1 Presentation of Findings and Results

The findings and results of this research are grouped under the various research questions of the research. For the research question one, data was gathered by using the various instruments that are selected as the research instruments in this research.

4.1.1 Test Based on Research Question 1, 2 and 3

After the students wrote the test on the applications on the Microsoft suite, it was wise going through the scripts of the students to find out the scores and know why they are facing such problems. Table 1 shows information of the pre-intervention text.

Table 1: Representation of Pre-Intervention Student's Performance.

Marks	Mid-Point (X)	Frequency(F)	FX	Fx^2
0-39	19.5	59	1150.5	22434.75
40-49	44.5	203	9033.5	401990.75
50-59	54.5	152	8284	451478
60-69	64.5	42	2709	174730.5
70-79	74.5	34	2533	188708.5
80-100	90	17	1530	137700
		∑F=507	∑FX=25240	∑FX^2=1377042.5

Mean Score=∑FX/∑F=49.76

Standard deviation $S=\sqrt{(\sum FX^2/\sum F)-(x)^2}$ =15.43

From table 1, only seventeen (17) representing three percent (3%) of the students scored from 80-100 marks. Thirty four (34) representing seven percent (7%) of the students scored from 70-79, forty two (42) representing ten percent (8%) scored 60-69, one hundred and fifty two (152) representing thirty percent (30%) of the students scored from 50-59, two hundred and three (203) representing forty percent (40%) of them scored

from 40-49 and the remaining fifty nine (59) representing twelve percent (12%) were those who scored from 30-39.

The findings above were seen at the pre-intervention stage of the research. The information gathered above gave the researcher an insight to the problem and the way forward in handling the problem to get a lasting solution to it. Below is the findings at the post interventions stage after all measures in addressing the problems were used and the researcher tried to find out as to whether the problem was solved or not. The information is grouped under the various tools just as in the pre-intervention stage.

4.1.2 Post Intervention Test.

When the students' scores in the various test were checked at the post intervention stage, the following information emerged.

Table 2: Representation of Post Intervention Student's Performance.

Marks	Mid-Point (X)	Frequency(F)	FX	FX^2
0-39	19.5	0	0	0
40-49	44.5	25	1112.5	49506.25
50-59	54.5	26	1417	77226.5
60-69	64.5	101	6514.5	418230.9
70-79	74.5	203	15123.5	1126700.75
80-100	90	152	13680	1231200
		∑F=507	∑FX=37847.5	∑FX^2=2902864.4

Mean Score=∑FX/∑F=74.65
Standard deviation $S=\sqrt{(\sum FX^2/\sum F)-(x)^2}$ =13.53

From table 2, one hundred and fifty two (152) representing thirty percent (30%) of the students scored 80-100, two hundred and three (203) representing forty percent (40%) scored 70-79 marks, one hundred and one (101) representing twenty percent (20%) scored 60-69 marks, twenty six (26) representing five percent (5%) scored from 50-59 marks and the remaining twenty five (25) representing five percent (5%) had 40-49 marks. All students were able to do the work. This indicates that the intervention measures that were taken have helped in improving the performance of the students.

The pre-intervention and the post intervention data gathered was compared to find out how best the situation has improve in the school. Table 3 is the T-test results between the pre-intervention performance of the students and the post intervention performance of the students.

Table 3: Paired Sample Statistics for Pre and Post Intervention Test

		Mean	N	Std. Deviation
Pair 1	Pre Intervention	49.76	507	15.43
	Post Intervention	74.65	507	13.53

CI = (.9500)

As it can be seen from table 3, a paired sample T-test of the pre intervention and post intervention performance of the students in the various tests reveals the mean for the pre intervention performance was 49.76 whiles that of the post intervention performance were 74.65 bringing a variance of 24.89. This shows the massive improvement of the performance. Also there was a standard deviation of 15.43 for the pre-intervention against 13.53 for post intervention which shows a wider variation in the marks at the pre-intervention stage than the post-intervention stage revealing an improvement in the performance.

Observation based on research question 2 and 3

4.3 Pre-intervention observation

An observation was made before the intervention to find out the competencies executed by the students. At the pre-intervention stage, students were observed during the pre-test. The emphasis was on the efficiency of the students. Speed, accuracy and easy to used were the parameters used in measuring their efficiencies. The speed was on how fast they can quickly carry out a task, the accuracy was on how they are able to avoid the mistakes and the easy to use was on how convenient they found it accomplishing the task that was given to them. For the aspect of efficiency, figure 3 represents the information that was gathered.
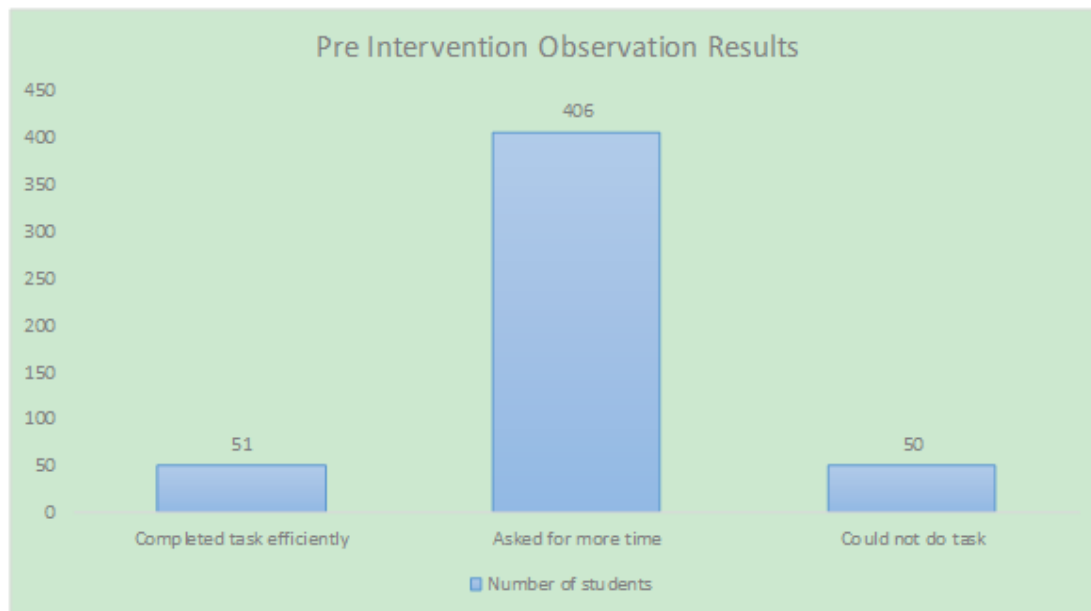
Figure 3: Results from Pre Intervention observation

From figure 3, it is realized that only fifty (51) students representing ten percent (10%) of the students were able to accurately and easily finish doing the work within the time allowed. Four hundred and six (406) students representing eighty percent (80%) of them requested for more time to complete the work and fifty (50) students representing ten percent (10%) of them could not just do the work at all.

4.4 Post intervention observation

When a post intervention observation was made to find out the improvement in students' performance in solving the problem, it was realized that the students' performance in the topic increased positively. They were able to go through the work with less stress and trauma and all students were able to do the work. This is because they were able to easily identify the various commands on the ribbon and locate them to execute a task. Figure 4 is a representation of the information.
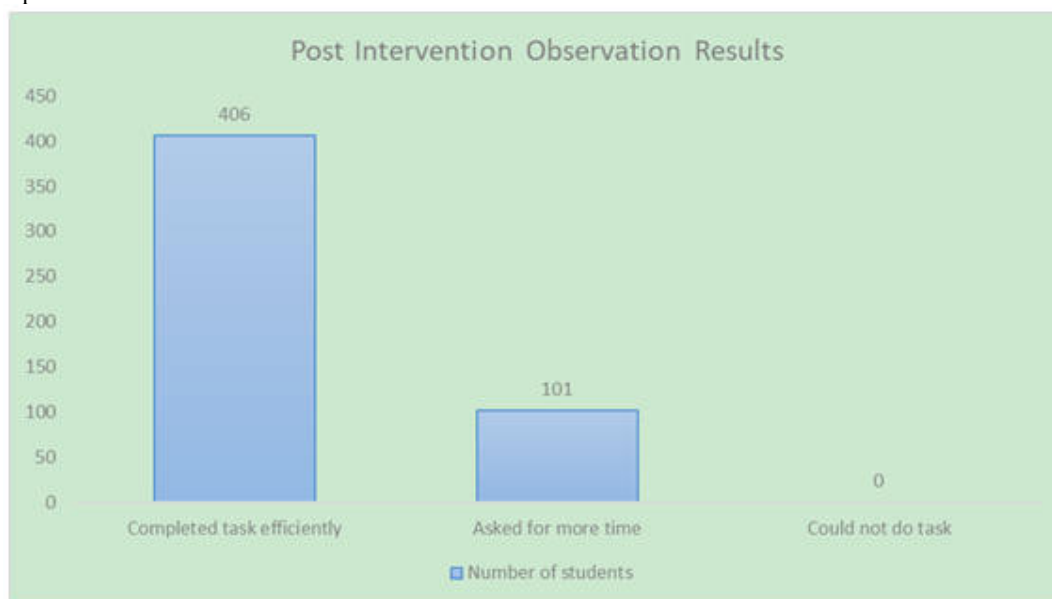

Figure 4: Results from Post Intervention observation

From figure 4, four hundred and six (406) representing eighty percent (80%) of the students were able to finish the work within the time that was allocated to it, one hundred and one (101) representing twenty percent (20%) requested for additional time and all students were able to do the work at the end.

5.1 Research Findings

Comparing the pre- intervention and post intervention results was necessary. This was done in relation to the various research questions that were used in conducting the research. The following information emerged.

From the research, it is realized that over seventy percent (70%) of students cannot carryout practical task when lesson delivery is mere demonstration without students practice in practical lessons in ICT. This is as a result of forgetfulness due to lack of practice.

It was realized that eighty percent (80%) of students who go through self-test (quizzing) to find out their level of understanding improves their learning.

From the research, it was realized that eighty percent (80%) of students can learn at their own pace in using multimedia tutorials in the absence of the teacher.

Interactive multimedia with options for quizzing to test learner understanding enables different groups of learners to learn and understand at their own pace.

Effective teaching and learning can be enhanced if the teacher trainee is given a personal computer (laptop) to go through the learning process in the college. This will help in easy integration of technology into the curriculum.

5.2 Conclusion

The problem of students finding it difficult to carryout practical task has been minimized. Students can now confidently carry out task and explain concepts as trainee teachers. Practice during and after a lesson is necessary for retentive memory and it will be prudent if stakeholders consider putting technological devices into the hands of the teacher trainee. The use of multimedia tutorial with quizzes has helped in improving the learners' performance. Leaners can continue revisiting this and learn at their own pace.

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