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Evaluation of Blended Computer Based Learning on the Performance of Students in Pre-Technical Skills in the Junior High Schools in Ghana

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Abstract

Evaluation of blended computer based learning on the performance of students in Pre-Technical Skills is essential in today's technological advancement. The study was conducted in the Bibiani district of the Western region. Probability sampling method (stratified and simple random sampling techniques) was used for the study. The population was made up of first year students of Central African Gold (CAG) Junior High School and Presby Junior High School. Both Schools took a Pre-test, the results of the pre-test assisted in grouping the schools into two. Central African Gold (CAG) Junior High School was selected as the Control group and Presby Junior High School as the experimental group. The experimental group was used together with traditional methods of teaching and computer software designed for the relevant topics. The statistical method used to analyse data for the study was independent-sample t-test. The level of significant chosen was 0.05. The "t" value found in the analysis of the difference between means was used to determine whether the null hypotheses concerning differences between post-test scores, and differences between the scores while controlling for pre-test scores, were to be accepted or rejected. The study revealed that students who used the blended computer based learning method performed better than those who were taught by the traditional method of instruction. It is recommended that the Ghana Education Service should offer in-service training in computer applications to teachers in our basic institutions. This will go a long way to equip them with the skills needed to design learning software in their various subjects such as that which was used in this research.

Keywords

Pre-Technical Skills, Computer Based Earning, Blended Computer Based Learning, Evaluation, Junior High Schools

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1. Introduction and Background

This paper seeks to find out the ways in which blended computer based learning can impact on the performance of pre-technical skills students in the Junior High Schools. This is because, many schools across the country are lacking facilities at the moment for learners to have a hands-on experience of the practical sides of the subject. With the use and availability of computers and Information and Communication Technology becoming expanded in educational establishments across the country, the research seeks to examine if a blended computer based approach can mitigate the situation where some students have no opportunities of any practical experiences of Pre-technical skills at all.

In the opinion of [5], the mere use or availability of Information and Communication Technology (ICT) does not automatically add quality to teaching and learning. It is possible to use them for trivial purposes, to waste students'

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time or even worse, use them for destructive or immoral purposes. The huge potential benefits held by use of Information and Communication Technology in education such as its enhancement of lessons by way of animations, videos, graphics, simulations and other applications risked being derailed by inappropriate, inapplicable and improper use. Clearly, urgent action is therefore needed to remedy this situation.

The solution will require teachers and graduates from both formal and informal Ghanaian educational institutions to be able to confidently and creatively use Information and Communication Technology tools and resources to develop requisite methods than can be used to engage their pupils and students. This process will also involve blended learning, a process by which different learning environments, methods, techniques and resources can be applied in meaningful ways to facilitate learning. Blended learning is an approach that combines face-to-face instruction with computer-mediated instruction. It also involves the merging of science and IT activities, in particular, with the use of innovative educational technologies such as computers, cellular phones, the internet, televisions channels and other electronic media.

Blended learning increases the options for greater quality and quantity of human interaction in a learning environment. It offers learners the opportunity "to be both together and apart." since a community of learners can interact at anytime and anywhere, on the back of computer-mediated educational tools. An important aim of blended learning is to provide realistic practical opportunities that can eventually facilitate independent learning by pupils and students using. This requires teachers to be facilitators, supervisors, assessors, organizers and managers of learning activities, which is why they need to be creative and competent. Learners can also be offered the opportunity to select activities best suited to suit their own pace, learning style and level, as well as time and place. This offers them to chance to be able to: make decisions, think creatively and critically, investigate and explore as well as solve problems they face in learning and real life. Beyond methods then, blended learning also demands collaboration between teachers and learners

One area that can best benefit from this sort of approach is technical education. In 1987, the reformation of the Ghanaian educational system saw technical skills and technical drawing introduced at the then Junior Secondary School level. Over the years, they were integrated into one subject, "Pre-technical Skills" and currently, it is grouped with home economics, and visual- art in a subject as basic design and technology. However after so many years since its introduction and various transformations, Technical Education is still plagued by a number of problems including inadequate teachers, students lack of interest in the subject and ultimately, poor performance of students in these technical subjects at the annual basic education certificate examinations. Pre-technical skill is a practical subject and like all practical subjects, students perform well when they are taught through demonstration. They understand the subject matter well when they are given a first-hand feel of the tools and equipment they are learning about [4].

Attempts have been made by successive governments to improve this practical access through the provision of workshops, basic bench tools and equipment to ensure effective teaching and learning. Nonetheless, many schools are still without workshops. Those who have them are also still in dire need of even the most basic training equipment. Teachers have therefore been forced to use a theoretical based approach to handle a subject that will have been better understood by learners through practice. The situation is even worse in the rural areas of Ghana such as Bibiani a mining town in the Bibiani-Anhwiaso-Bekwai District of the Western Region. The Western region itself is well endowed with minerals like gold and bauxite among others. Falling within a part of the country traditionally seen as the breadbasket of the nation, there is also a vast growth of vegetation in this area. Foodstuff, agricultural and forest products such as cocoa, coffee, timber, rubber and others are therefore in abundance. Unsurprisingly, most of the inhabitants of this region are either farmers or miners.

The Information Communication Policy of Ghana clearly states that Information and Communication Technology is used in creating new ways of learning. It has the potential to enhance the management and administrative capacity of schools. According to the Curriculum and Research Development Division of the Ghana Education Service, "Information and Communication Technology has become an important medium of communication and work in a variety of areas. Knowledge of Information and Communication Technology has therefore, become a pre-requisite for learning in schools in the current world" [3]. A cornerstone of this approach is the perception that the influx and integration of Information and Communication Technology into the educational system can lead to improvements in the educational system.

The purpose of the study was to ascertain the relation between the performances of Junior High School students who taught using blended computer based learning methods and those taught using only traditional methods of teaching Pre-Technical Skills. The study sought to examine the impact of a blended computer based learning on the performance of students towards the study of Pre-Technical Skills. The research was guided by this question- to what extent can students' performance in Pre-Technical Skills can improve as a result of a blended Computer based learning?

2. Literature Review on the Use of Information and Computer Technology (ICT) and Technical Education in Ghana

In many Ghanaian schools, for the most part, the chalkboard is still the dominant tool of teaching. The merits of other alternatives such as information technology and computers to enhance teaching has long been recognised and espoused by education officials. Nonetheless, financial and infrastructural constraints have hampered efforts at rolling these out to many schools and educational establishments. However, the situation is not entirely bleak as education officials have not reneged on efforts to ensure that schools are provided with computers and other Information and Communication Technology facilities. It has therefore become common today to find a substantial number of schools, particularly those in the private sector with an appreciable number of computing facilities.

However, although hardware and software are gradually becoming a normal part of teaching in many Ghanaian universities, polytechnics, colleges of education among others, it is not entirely clear how its benefits or failures are been established. This has mostly been because there seems to be a lack of creativity and understanding of the ways in which computers can be used to achieve teaching and learning goals such as the improvement of performance and the enhancement of students' interest in certain subjects that have traditionally failed to attract students. This failure to adapt computers and Information and Communication Technology to our localised scenarios and settings also arises because teachers are unable to weave information technology into the existing teaching and learning [3].

Blended learning (also called hybrid learning) is the term used to describe learning or training events or activities where e-learning, in its various forms, is combined with more traditional forms of instruction and training within the classroom [16]. It is a method whereby different instructional tools and methods like as collaborative software, web-based courses, EPSS, and knowledge management practices are all brought together [6]. Blended learning to these researchers [11, 19] also described it as a method that involves the combination of numerous instructional modalities. However, blended learning on the other hand was seen by [13, 23, 24] as the combination of online and face-to-face instruction.

Clearly, from all these definitions, it is obvious that blended learning involves a myriad of different learning environments. However, an equally crucial aspect is that the combination must be done in a creative manner in order to achieve interactive and meaningful learning environment. Similarly, learners should have easy access to different learning resources in order to apply the knowledge and skills they learn under the supervision and support of the teacher inside and outside the classroom [2]. Therefore the most ideal situation will be one where face-to-face instruction is joined or complemented by computer-mediated instruction [2]. Having attended normal lessons where both methods have been used, the learner then has the opportunity to continue knowledge acquisition through appropriate computer software and by other relevant electronic media on their own [20].

According to [15] the merits of blended learning can be realised instantly if it is rolled out properly. For learners, it offers a chance to progress at their own pace, learning style, time and place. It can engender the capacity for learners to become independent and self-reliant in their own learning. Another positive development can be an increment in their abilities to make decisions, think creatively and critically, investigate, explore and solve problems that they face within the classroom and in real life [18]. This can in turn significantly improve learners' performance and ultimately reduce the burden of duty for teachers themselves because if learners are able to seek certain answers out themselves, they will not have recourse to go to the teacher all the time [6]. For all this to become possible, certain critical considerations need to be addressed first; when is it appropriate to use blended learning as opposed to traditional methods? Some of the key factors to help in making this decision include the nature of the subject being taught, the nature and location of the audience, and the resources available [21].

Following an in-depth cross-analysis of these three major parameters, if the course designer arrives at the conclusion that blended learning is appropriate, then a final major hurdle needs to be overcome to ensure that the best possible experience is offered. A decision will have to be made on the parts of the course or lesson that are placed within an Information and Communication Technology learning environment and those that are best placed in the traditional face to face format [20]. For instance, faced with this decision for their English language courses at [10] the instructors decided that all audio-based activities including listening comprehension and oral expression will be classroom based because there require direct interaction and group participation whereas text oriented activities such as reading comprehension, essays writing and others which many prefer to do in silence, will take place online.

Once all of these hurdles have been cleared, then the groundwork is complete for the course design to begin. There are diverse ways of doing this but in general the process is not much different from the usual methods of designing

courses. The only exception is that this time, attention must be paid to the fact that portions of the programme will be available online and learners will have to access these themselves. Hence the modules must be presented in very simplified and self-explanatory ways such that with very little or even no supervision, learners can understand these themselves and assess themselves. This mode of assessment in the views of [22] has offered a very useful commentary on the ways in which learning goals can be achieved in the classroom situation. Once the programme is ready, instructors need to decide what mode of motivation and approach they wish to adopt with their students. For learners to be active in hybrid learning [10] identified these three approaches- skills-driven, behavioural-driven and competency-driven derivations to help learners to design their own learning programme.

A skill driven approach implies interaction with a facilitator through email, discussion forums, and face-to-face meetings, complemented by web-based courses and books. This type of approach is analogous to a chemical reaction, in which interaction with the instructor acts as a catalyst to achieve the desired reaction; learning. According to a survey in 2000 by the Masie Center, 88 percent of learners and 91 percent of managers recommend that the trainer or facilitator be an active part of the online training program. Survey respondents placed a high value on having a trainer who monitors their progress, who engages with them regularly. They also cited the need for their instructors to help them build and facilitate an online community and to respond to content questions in a timeous manner. It is clear then that combining self-paced learning with facilitator support keeps the learner from feeling isolated, which assists in the successful completion of the self-paced modules [21]

Indeed, this approach works best when people are learning content at the knowledge or application levels. In other to incorporate skill-driven blended learning [21] outlined the following techniques:

1. creating a tightly scheduled group learning plan
2. using instructor-led overview and closing sessions
3. using synchronous learning labs
4. Providing support to learners through email, in other for learners to become autonomous in their own learning

A behaviour driven learning approach on the other hand involves traditional classroom-based learning with online collaborative learning events. At times, the nature of the content, as well as the desired outcome necessitates the inclusion of collaborative learning that's facilitated through face-to-face sessions or technology-enabled collaborative events. Developers should use this approach to teach content that requires learners to try out new behaviours in a risk-free environment. For example, soft skill courses that require role playing and similar interactive activities should employ a behaviour-driven approach [10]. Activities that developers should incorporate into the overall learning experience include discussion forums, group projects, and online debates that use chat modules.

Competency-driven learning according to [10] can be described as performance support tools with knowledge management resources and mentoring to develop workplace competencies. The success of knowledge workers depends on how quickly employees make decisions in the work place. While part of the decision-making process is guided by common facts and working principles, people also need tacit knowledge that is often retained by experts. Learning that facilitates the transfer of tacit knowledge may be best served by a competency driven approach because people absorb tacit knowledge better by observing and interacting with experts on the job. Activities to be employed include a blend of online performance support tools with live mentoring [10].

Knowledge and technology are increasingly becoming the basis of competitive advantage in the present world economy. The quality of a country's stock of human capital influences the extent to which knowledge and technology can be utilised and created to enhance productivity and increase the well-being of citizens. Human capital, as a learning tool was pointed by [9] as "not just the skills generated by formal education and training, but also those created by on-the-job training and the experience of technological activity and the legacy of inherited skills, attitudes and abilities…" (p. 170). A significant proportion of the knowledge base and skills of the work force in Ghana is tradition bound. If the competitiveness of Ghana in the world economy is to improve, the knowledge base, techniques of production and skills of the work force must be broadened beyond the confines of inherited skills, attitudes and abilities.

Formal education is an important part of the skill acquisition process and development of the stock of human capital. It contributes to the process of moulding attitudinal skills and developing technical skills. Education increases the ability to understand and critique new ideas. It facilitates the adoption and/or modification of technology. For example, in agriculture, if modern farming practices are to be adopted and effectively implemented, farmers must be able to read instructions on how to use the new inputs [4].

Technical Education plays a vital role in human resource development of the country by creating skilled manpower, enhancing industrial productivity and improving the quality of life. Technical Education covers courses and programmes in engineering, technology, management, architecture, town

planning, pharmacy and applied arts & crafts, hotel management and catering technology according to [7].

Technical Education was introduced in Ghana over half a century ago. By 1922, four Vocational and Technical Schools had been established in the Ashanti, Eastern, Greater Accra and Central Regions. Courses offered at that time were Woodwork, Metalwork and Brickwork. Metal work and brickwork were considered essential for improving the quality of life of the people. As noted by Foster, the aim of these schools was to encourage "the development of habits of steady industry, leading to a settled and thriving peasantry. The desire to improve the socio-economic life of the people through technical education continued to engage the attention of the colonial government. By 1925, another school was established at Yendi, in the Northern Region of Ghana. This development went on until the Second World War during which the schools were converted into army training schools in which all sort of craftsmen were trained to help the war efforts. [16].

When the war was over, the schools were renamed, trade schools and courses such as blacksmithing, metal- making, auto-mechanic and electrical practice were added to the existing ones. The addition of these courses was deemed necessary to provide skilled craftsmen for the country's mining and timber industries. The Government felt the need to increase the number of schools from five in 1953 to eight in 1956 to train sufficient manpower to meet the demands of industry. In the course of these developments, the schools were re-named Technical Institutions. They also began to offer courses leading to the City and Guilds Certificates [17]. As part of the government's accelerated educational programme launched in 1951, technical education gained an even stronger foothold in the nation's education curriculum. The number of technical institutions was progressively increased till today and there are now several polytechnics, technical institutes, technical teacher training institutes and similar institutions all over the country offering training and instruction in a myriad of technical subjects [7].

In 1987, the government of Ghana instituted a new education structure as part of which Junior Secondary Schools (JSS) were to replace the four-year middle schools. The importance of technical education was recognised once in the decision, as part of this restructuring, that JSS education must include basic technical and vocational education. The strands of technical education that were identified for the JSS curriculum were metalwork, woodwork and block work, as in the early days of technical education. Technical drawing was also included in the course content for all JSS students. The major aim for making technical education a core part of the JSS curriculum was to prepare students to take up technical education after JSS, for those aspiring to go to Senior Secondary School (SSS), or to take up technical professions, for those who may want to be enrolled in technical apprenticeships after JSS

To show its commitment to technical education, the Government made it the responsibility of District Assemblies to provide the requisite tools, materials and equipment to the various JSS within their administrative areas. These provisions will enable students to undertake practical lessons which were an integral part of the technical education curriculum. Teachers were not left out of the mix either. New teachers were trained specifically to teach technical subjects while others who were already in the field, but teaching different subjects were asked to switch from their existing fields to technical education

As part of efforts to streamline the teaching and learning of technical subjects, in the late 1990s, technical skills and technical drawing were merged to be taught as a single subject, on the recommendation of the Technical and Vocational Education Division (TVED) of the Ghana Education Service (GES). Given a new name Pre-Technical skills, the new subject therefore included technical skills, technical drawing and an additional module called design process [1]. The design process aspect was to equip students with the basic skills involved in designing and making artefacts.

Things stayed that way until 2007 when the educational sector was reformed once again, with a resultant impact on technical education at the JSS level once more. This time, Pre-Technical skills, Visual Art and Home Economics were grouped together as a new subject; Basic Design and Technology. Nonetheless, the new approach, still offers schools and students the option of selecting any of these subjects for specialisation without having to study any of the others at all [8].

Clearly, technical skills education in Ghana has undergone several transformations and is steeped in the history of the country itself. Unfortunately, this has not been entirely smooth sailing. It is a subject area faced with a lot of difficulties. Some of these challenges were identified by the Education Review Committee in 2002. Overall, the report concluded that at the JSS level, Technical and Vocational Education and Training (TVET) which incorporates technical education is disappointing. Some of the issues that were highlighted include:

i. Poor funding

ii. Failure to attract students- only 1.6% of educated people had Technical and Vocational Education and Training.

iii. Too much emphasis placed on grammar education (495 general SSS as against 25 technical institutes under

Ministry of Education Science and Sports)

iv. Inadequate preparation of Technical and Vocational Education and Training instructors.

v. Neglect of informal sector by government.

vi. Inadequate academic progression in Technical and Vocational Education and Training.

vii. Inadequate capacity for training and management [7].

This issues raised in the report are quite unfortunate given the fact that the development of technical skills is not just an academic exercise but it is also a subject that can serve as a direct means of livelihood if learners are trained adequately. The situation is even more alarming when one considers that technical skills as a subject is generally looked down upon in various sections of the country. Some of these perceptions and challenges to the subject include, but are not limited to the following:

i. Poor public perception of technical education

ii. Perceived only good for low academic achievers

iii. Multiplicity of standards, testing and certification

iv. Poor remuneration and condition of service for technical skills education personnel compared to other academic courses

v. Inadequate and obsolete training equipment and facilities

vi. Inadequate career guidance, counselling, placement and follow up services [7]

Technical education has its own problems, this made [7] in his findings to sum up these challenges aptly when he states that a major problem of is unsatisfactory quality instruction, inadequate instructor preparation and lack of instructional support. As with all technical subjects, Pre-technical education involves and requires substantial practice by students. Students are best placed to grasp what they are being taught when they have the opportunity for practical demonstrations, simulations and so on. They understand the subject matter well when they are given a first-hand feel of the tools and equipments which they learn about as [4] has rightly observed.

However, as has been shown earlier, the multiplicity of issues plaguing the subject area has resulted in the subject being taught mainly at the theoretical level with virtually no practical activities for students, a point which [8] has also noted. Therefore, with the introduction of Basic Design Technology where students are given the chance to select from three main subject areas; Home Economics, Visual Art and Pre-Technical skills, most of them refuse to choose the latter [1]. The position of this research however, is that now that Information and Communication Technology is being introduced into Ghanaian schools, this trend can possibly be changed. By finding creative ways of blending the use of Information and Communication Technology with traditional methods, it may serve to compensate for the lack of facilities which has long plagued the teaching and learning of technical stills in schools. It is on this basis that the research sets out to examine how such an approach will be possible and if it can have the desired impact on the performance of Pre-technical Skill students.

3. Methodology

Probability sampling method (stratified and simple random sampling techniques) was used. The population for study was made up schools in Bibiani-Anhwiaso-Bekwai district of the Western Region. However, the target population was schools in the Bibiani Township and its neighbouring environment. The accessible population was made up of first year students of Central African Gold (CAG) Junior High School and Presby Junior High School.

A multi-stage sampling procedure, consisting of stratified and simple random sampling techniques was used. The schools in the Bibiani Township and its environs were stratified into two groups. One group, “A” was made up of schools in the Bibiani Town itself and the other group was also made up of schools in the Bibiani environs. This was to give all units within the strata of the target population, an equal chance of being selected. Simple random sampling was then used to select a school from each of the two groups. The school sampled from both groups undertook a pre-test and based on the result of the pre-test; one School was made the experimental group and the other the control group. In all sixty-eight (68) first year students from both schools were used in this research as the sample size. These students were selected because they are assumed to be in a better position to provide the relevant information for the accomplishment of the research goal.

The researcher used teacher-made test as instrument for study. It was made up of pre and post-test items which were different from each other. The analyses involved the use of simple descriptive statistical tools and mathematical calculations, which were facilitated by computer packages namely Excel and the Statistical Package for the Social Sciences (SPSS). The statistical method used to analyse data for the study was independent-sample t-test. The level of significant chosen was 0.05. This was to ensure that results were significant on any statistical test used to analyse data in the study. The “t” value found in the analysis of the difference between means was used to determine whether the null hypotheses concerning differences between post-test scores, and differences between the scores while controlling

for pre-test scores, were to be accepted or rejected.

4. Findings and Discussions

The main objective is to establish pre-test and post-test scores of both Experimental and Control groups in blended computer based learning and Pre-Technical Skills. The study sought to examine the impact of a blended computer based learning on the performance of students towards the study of Pre-Technical Skills.

Two data collection components a pre-test and post-test were used for this study. Each test comprised twenty questions. The scores and percentages obtained by CAG JHS (Control Group) were as follows: Of the 20 multiple-choice questions, five pupils representing 16.67 percent of the population scored 5, five students representing 16.67 percent scored 6, five pupils representing 16.67 scored 7, and four pupils representing 13.33 percent scored 8. One representing 3.33 percent of the population scored 9. The table below shows the detailed summary statistics for the CAG JHS.

Table 1. Pre- Test Results of CAG Junior High School (Control Group).

Score	Frequency	Percent
5	5	16.7
6	5	16.7
7	5	16.7
8	4	13.33
9	1	3.33
10	2	6.67
11	2	6.67
14	3	10
15	2	6.67
16	1	3.33
TOTAL	30	100

From table 1 above, it can be seen that, the highest score of the control group was 16 and the lowest score was 5.

A bar chart showing the frequency distribution for CAG JHS is shown below

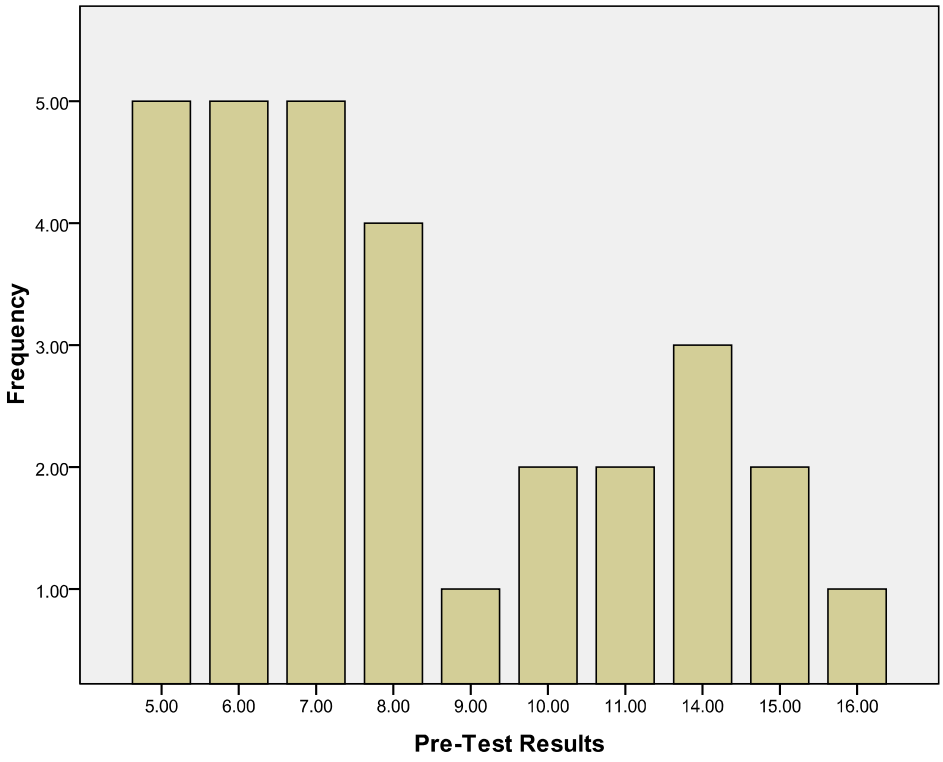

Figure 1. Frequency distribution of CAG JHS Pre-Test scores.

From the chart, it can be seen that the distribution of the pre test scores for CAG suggests that the performance of the students was fairly normally distributed. This satisfies an important condition for the use of the t-test of independence to investigate differences between the two groups (i.e. control and experimental groups).

Table 2 shows the scores and percentages obtained by Presby JHS (Experimental Group). Out of the 20 multiple-choice questions, two students representing 5.26 percent of the population scored 4, two scored 5, four representing 10.52 percent scored 6 and four scored 7. Nine representing 23.68 percent scored 8, seven representing 18.42 percent of the population scored 9, three scored 10, four representing 10.53 percent scored 11, one representing 2.63 percent of the population scored 12, and two representing 5.26 percent of the population scored 13.

A statistical results summary of Presby JHS is shown on table 2 below.

Table 2. Pre-Test Score for Presby JHS (Experimental Group).

Score	frequency	percent
4	2	5.26
5	2	5.26
6	4	10.2
7	4	10.52
8	9	23.68
9	7	18.42
10	3	7.89
11	4	10.53
12	1	2.63
13	2	5.62
Total	38	100.0

From table 2, it can be seen that the lowest score for the experimental group was 4.00 and the highest score was 13.00. These figures are exhibited on figure 2, the bar chart below

A bar chart showing the frequency distribution for Presby JHS is shown on below

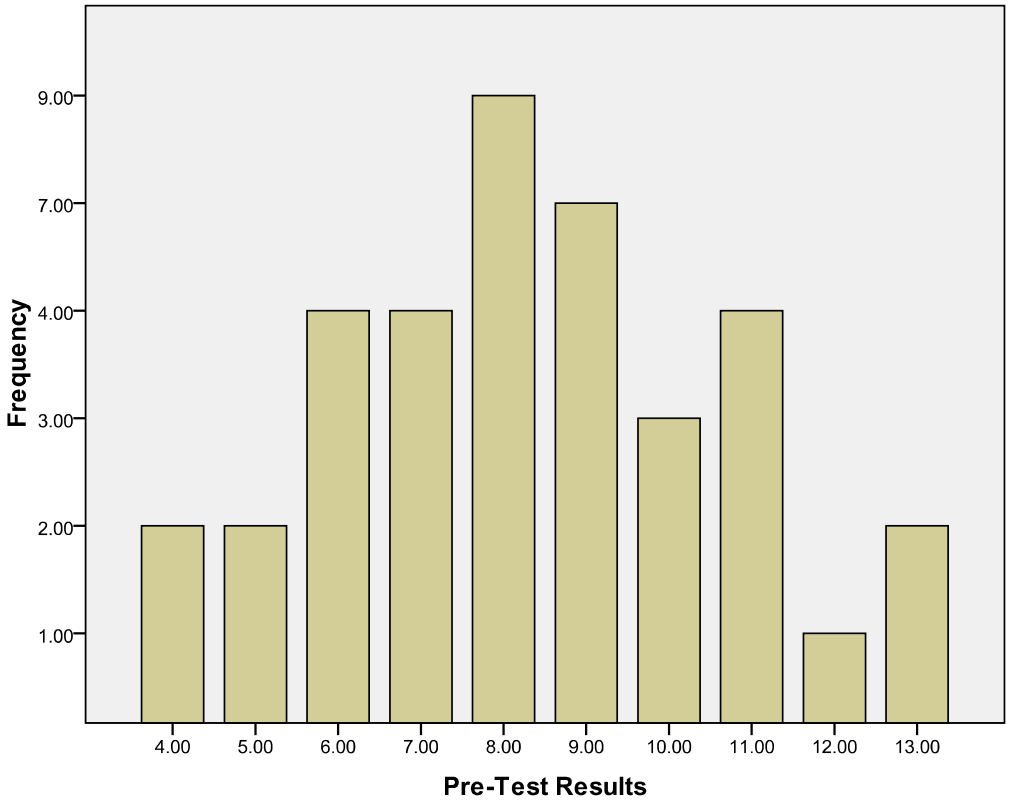

Figure 2. Frequency distribution of CAG JHS Pre-Test scores.

Again, by inspection, it can be seen that the distribution is fairly normal as explained below using the pre-test averages. In this case too, an important condition for the use of t-test is met. The mean scores and standard deviations of both CAG JHS and Presby JHS are also presented on table 3 below. These scores were used to determine which groups will be taught with either the blended computer based learning approach or the traditional method of teaching. CAG School had a mean score of 8.70 while Presby JHS had a mean score of 8.03. The similarity of their standard deviations (CAG – 3.49, and Presby JHS – 2.60) suggested that the variations in the scores within the groups were equally fairly similar. This further implied, on the basis of the mean score, that CAG School students did better in the Pre-test. Hence, CAG JHS was nominated at the control group and Presby JHS, the experimental group.

Table 3. Mean and standard deviation of experimental and control groups.

Groups	Mean	N	Std. Deviation
Control Group	8.70	30.00	3.49
Experimental Group	8.03	38.00	2.60
Total	16.73	68.00	6.08

Table 4 and 5 shows the three averages (Mode, Median and Mean) of both CAG School and Presby JHS.

Table 4. Mode, Median and Mean for CAG School (Pre-Test).

N	30.00
Mode	5.00
Median	7.50
Mean	8.70

Table 5. Mode, Median and Mean for Presby School (Pre-Test).

N	38.00
Mode	8.00
Median	8.00
Mean	8.03

The mode, median and mean scores of CAG School was 5.00, 7.50 and 8.70 respectively whereas that of Presby JHS was 8.00, 8.00, and 8.03. A fair distribution of scores can be deduced from this data because the three averages were nearly the same. As explained earlier, it is on this basis that the use of the t-test hypothesis was permitted. Figure 3 below further illustrates this point

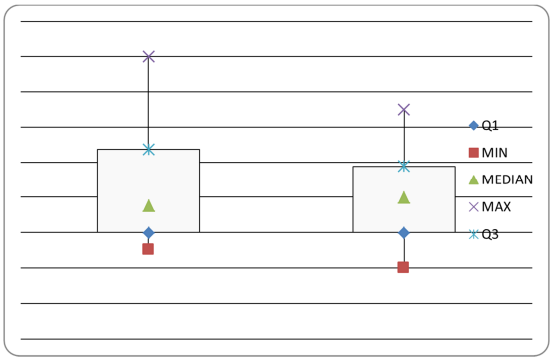

Figure 3. A box plot showing Pre-Test Scores for both Groups.

Figure 3 shows a box plot of the pre-test scores for both the control and experimental group. The plots use the lower and upper quartile, minimum range, median, maximum range and upper quartile. As shown on the image, the control group had a lower quartile of 6 and upper quartile of about 10.75, minimum mange of about 5 and a maximum range of about 16, as well as median of about 7.5. This indicates that, the Control Group performed better than the experimental Group which had a lower quartile of 6 and an upper quartile of about 9.73, minimum mange of about 4 and minimum mange of about 13, and a median of about 8.

Post-Test scores and percentages obtained by the control Group are presented in Table 6. Out of the 20 multiple choice questions, one student, representing 3.33 percent of the population scored 5, four representing 13.33 percent scored 6, five representing 16.67 percent of the population scored 7, eight representing 26.67 percent of the population scored 8, 3 representing 10 percent of the population scored 3, four representing 13.33 percent of the population scored 10, one student representing 3.33 percent of the population scored 11, one person representing 3.33 percent of the population scored 12, two representing 6.67 percent of the population scored 6.67 and one student representing 3.33 percent of the population also scored 15.

Table 6. Post Test Results for CAG School (Control Group).

Score	frequency	percent
5	1	3.33
6	4	13.3
7	5	16.67
8	8	26.67
9	3	10.00
10	4	13.33
11	1	3.33
12	1	33.33
14	2	6.67
15	1	3.33
Total	30	100

It can be seen from the above that the lowest post–test score of CAG School was 5 and the highest score was 15. Figure 4 illustrates these distributions.

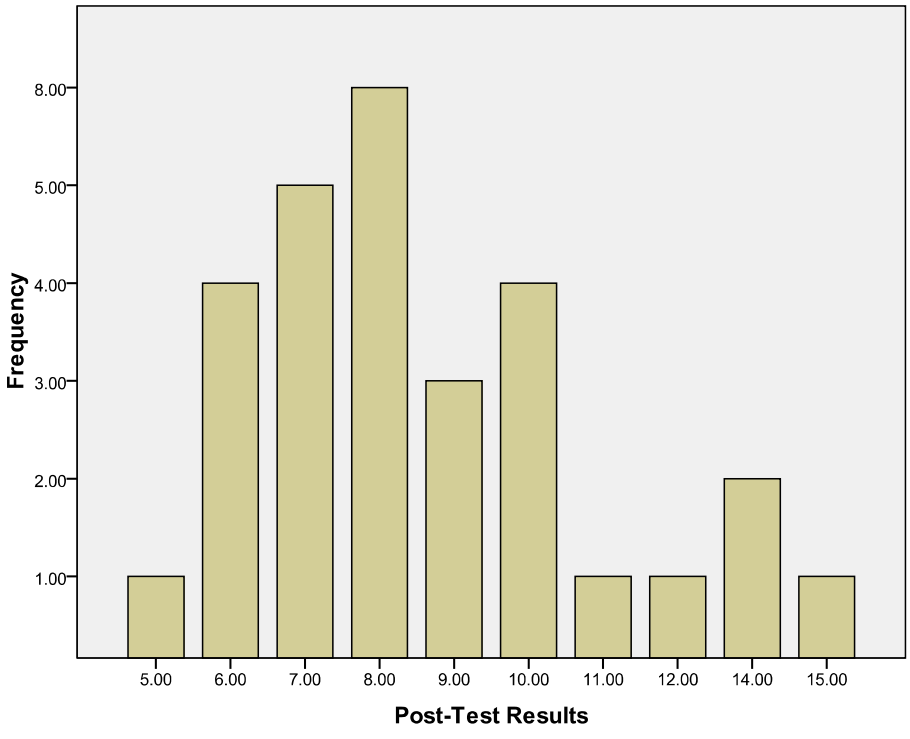

Figure 4. Bar Chart Showing Post Test Results of CAG School.

The chart shows that the scores were fairly distributed. The control group had a mean of 8.7 indicationg that, their performance in the post test was a little above that of the pre-test.

Post-Test scores for Presby JHS: out of the 20 multiple choice questions, one student, representing 2.6 percent of the total population scored 5, one student representing 2.63 percent of the population scored 6, two students representing 5.26 percent of the population scored 8, nine students representing 23.68 percent of the population scored 9, four students representing 10.53 percent scored 10, five students representing 13.16 percent of the population also scored 11, five students representing 13.16 percent scored 12, four students representing 10.53 percent scored 13, two students representing 5.26 percent scored 14, two students, representing 5.26 percent of the population also scored 15 and three pupils representing 7.89 percent also scored 16. These are highlighted on table 7 below.

Table 7. Post – Test Scores for Presby JHS (Experimental Group).

Score	frequency	percent
5	1	2.63
6	1	2.63
8	2	5.26
9	9	23.68
10	4	10.53
11	5	13.16
12	5	13.16
13	4	10.53
14	2	5.26
15	2	5.26
16	3	5.26
Total	38	100

Evidently, the lowest post-test score for Presby JHS was 5 and the highest was 16. A bar chart showing the distribution of post test scores for Presby Junior High School is shown in Figure 5 which demonstrates even distribution among the marks obtained by Presby.

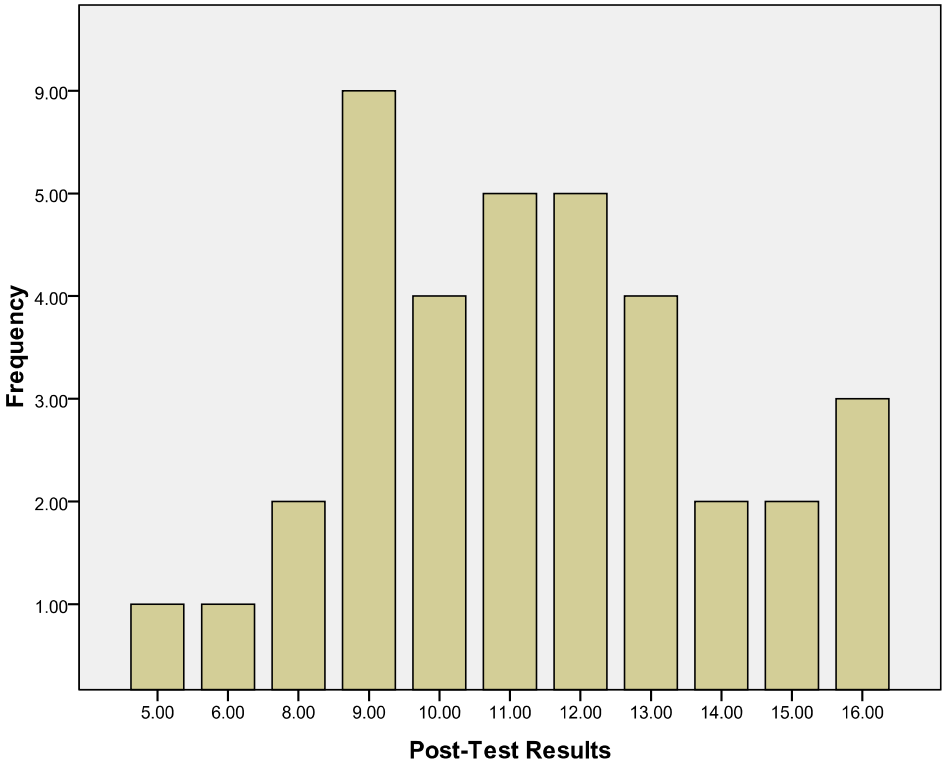

Figure 5. A bar chart showing Post Test Results of Presby JHS.

The means, standard deviation and standard errors of the mean for both groups are shown in Table 8 below. The mean for the experimental group was 11.08, standard deviation 2.675 and standard error of mean .434 respectively, whiles the control had a mean 8.70, standard deviation 2.493 and standard error of mean .455 respectively. Analysis of the means showed that on post-test scores, students in the experimental group, using the software had a mean score of 11.08, which was 2.38 higher than the mean score of 8.70 for the students in the Control group, using only traditional methods of Instruction.

Table 8. Mean standard deviation and standard errors of the mean for both groups.

Group	Mean	N	Std. Deviation	Std. Error of mean
Control	8.70	30	2.493	.455
Experimental	11.08	38	2.675	.434
Total	I9.78	68	5.168	.0889

The three averages – mean mode and median for the Control and Experimental groups are displayed in Table 9 below.

Table 9. Mean, Median and Mode of Control Group (Post-test).

N	40
Mean	8.70
Median	8.00
Mode	8.00

Table 10. Mean Median and Mode of Experimental Group (Post-test).

N	N	38
	Mean	11.00
Median		11.00
Mode		9.00

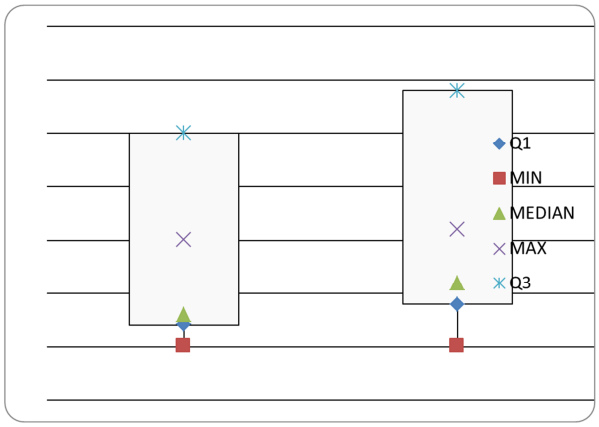

Figure 6. Box Plot showing Post Test Scores for both groups.

The post –test scores for both groups are shown on the lower quartile the minimum range, median, maximum range and the upper quartile of the figure. A study of the graphs shows that the control group had a lower quartile value of about 7, a minimum range of about 5, a median of about 8, a maximum range of about 15 and upper quartile of about 25. The experimental group on the other hand had a lower quartile of about 9, a minimum range of about 5, a median of about 11, a maximum range of about 16 and upper quartile of about 29. This is evidence that the experimental group performed better in the post-test than the control group.

Table 11. Levene's Test for Equality of Variance on the Scores of the Two Groups.

	F- value	P-value
Equal variance assumed	0.386	0.05

Table 11 above shows the results of the Levene's test conducted. The Significant Value (F-Value) was 0.386 which is larger than the significance level of Levene's test (P-Value) of 0.05. This means that, the scores of the two groups were of equal variance. Hence the corresponding t-value was taken.

Table 12. Independent Samples t- test on Groups Mean Scores.

Group	Mean	Mean Difference	Std Deviation	t-value	Sig (2-tailed)
Control	8.70	2.379	2.493	-3.75	0.001
Experimental	11.08		2.675		

Table 12 shows the relevant statistics needed to test the main hypothesis of the study. The table also shows the results of the t-test of independence done to investigate the difference between the two means.

The results in the table above show that the t-value calculated was -3.75 with a value of 0.001 in the Sig (2-Tailed) column. The Sig. value is less than .05 indicating that, there is a statistical significant difference in the means of scores of the dependent variable for each of the two groups. The Null hypotheses which stated that: "There is no difference in the performance of students in Pre-Technical Skills before and after they have experienced a blended Computer based learning" is therefore rejected. Eta Squared which indicates the magnitude of the differences between the two groups called Effect size was calculated from the relation below:

$$\text{Eta squared} = \frac{t^2}{t^2 + (\text{N1} + \text{N2} - 2)}$$

Where t^2 = square of the t-value and N1 and N2 = number of respondents in groups.

The Eta squared value obtained was 0.180 which is more than .14 indicating a large effect size. An independent samples t-test was conducted to compare the post test scores of students who were taught using the traditional method of teaching (control group) and those taught using computer based blended learning (experimental group). A significant difference in scores was established for the control group (M = 8.70, SD = 2.493) and the experimental group (M = 11.083, SD = 2.675) the magnitude of differences in the means was very large (eta squared = 0.180).

As noted in the data analysis, the use of blended computer learning has numerous advantages over the standard traditional method. This view has been confirmed to be accurate as the results of the research has shown that students in the experimental group who were taught in a blended computer based learning environment achieved significantly higher post-test scores than those in the Control group who went through the traditional method of teaching. The researcher worked with the experimental group using computers for four weeks and it is believed that this is another factor that supports the claim. Students developed confidence in their use of computers and general outlook over this period and on the whole, a positive relationship can be seen to exist between students attitude and computer

usage. The researcher is of the view that the experimental group performed better in the post-test due to the fact their instructional method was a blend of both the traditional method and computer instructions. The use of the computer lab, the classroom and other additional facilities offered a wider and better general environment conducive for effective teaching and learning. The students were able to work according to their own pace, learning style and level. Overall, a greater sense of independence, self-reliance, and confidence in problem solving, asking questions and contributing to class discussions was observed over the period or the research.

Learning may also have been facilitated by the fact that topics were provided in a more structured manner which was easily facilitated by the use of the computers. Each lesson had questions at the end to provide students with a means of testing themselves on what they had just learnt. Immediate and prompt feedbacks to these tests were provided by the software. They were also provided with a general question that covered the whole study. This in the researcher's opinion provided a form of students' motivation toward the subject matter to be learned. A possible reason for the enhanced performance of the experimental group can also be the fact that computer instructions for each topic was left on the computers, students had the opportunity to go over and over again at their own pace until they understood a topic. Hence as opposed to the traditional methods, because the blended format offered students easy access to what had been taught in the past and what the instructor had said previously, they were able to remember by simply referring to the instructions all over again. This may have been another advantageous factor.

Contrarily, the control group's performance was affected due to the fact that they had very little interest in the subject as had already been the case. This lack of interest is one of the issues that have been highlighted as a challenge to the earning of the subject by Ghanaian educational authorities. While the use of computers and a varied learning environment offered the experimental group the chance to break out of their boredom with the subject, for the control group, it seemed to be business as usual and their interest therefore remained low. Efforts were made to rekindle their interest by attempting classroom based games and activities but once we went back to the lesson or subject at hand, they seemed to recoil back into the perception that the subject was uninteresting.

Again, the fact that the control group did not have the chance to go over lessons at their own pace till such a point where they themselves felt they had clearly understood what they were learning might also have been be a contributing factor to their lower performance. It is widely accepted that the more a student is able to practice what they had been taught, the greater the likelihood that they will understand it perfectly. While the experimental group had access to computers with simulations and teaching noted to revise what they had learnt, the control group were only limited to the classroom, notes they had been given and this relatively limited option seemed to have worked against them, unfortunately

It can therefore be said that that on the whole, there results of the study supports some of the claims that have been made on the benefits of blended learning technology over the traditional classroom based approach and indeed the use of computers or e-learning alone to teach students [18] The introduction of Information and Communication Technology into Ghanaian schools is very opportune because for subjects like Pre-technical skills it can be a means of reviving students' interest. In this research, it was clear to see the excitement and huge interest aroused in the experimental group by the fact that they were experiencing the use of computers. This was even more so because a subject which they had considered to be difficult, boring and uninteresting had suddenly become very easily understandable and accessible since they had had both pictures and simulations to show what the whole thing was about.

As Quinn, (1993) has argued, the above is one of the major benefits of blended learning involving computers and the traditional method as opposed to any single method. Quinn equally asserts following prolonged exposure to this method of teaching and learning, students' problem solving skills can be heightened because of the opportunity they have been offered to practice and refine their higher-order thinking strategies. While the research did not necessarily span a very long period, there was nonetheless evidence supporting this assertion because over the one month period, clear differences were observed between the behaviours, attitudes and general postures of the two groups. That of the experimental group was more positive and they seemed more alert than their original behaviours and demeanours at the start of the research and in comparison to their peers in the control group

5. Conclusions and Recommendation

In conclusion, the result of the present study indicates that students who used the blended computer based learning method performed better than those who were taught by the traditional method of instruction. The post test scores of both groups have shown, if properly implemented, a blended learning approach can result in very positive outcome for both students and teachers of Pre-technical skills. A major

challenge to the use of this method in all schools nationwide is the problem of infrastructure. This includes lack of computers and even electricity in some parts of the country. However for those schools which already have computer laboratories but no facilities or tools for practical lessons, the computer laboratory can be used as part of blended learning methods. This is why proper planning and careful usage, monitoring and evaluation is required in order to ensure that the true benefits of are achieved

It is recommended that the Ghana Education Service should offer in-service training in computer applications to teachers in our basic institutions. This will go a long way to equip them with the skills needed to design learning software in their various subjects such as that which was used in this research.

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