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Efficacies of Technology-Based Instruction in the University of Cape Coast Distance Education Programme

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Abstract: Technology use in education is essential for effective teaching and learning, and preparing students for the world of work in the 21st century. This study sought to examine the efficacies of technology-based instruction in the University of Cape Coast distance education programme. A between-subject experimental design with three (3) independent groups was employed. Using a simple random sampling technique, 181 participants from three programmes (63:58:60) were given different treatment with regards to teaching and learning. The participants were assessed after 8 weeks of teaching and learning. A two-way ANOVA was conducted to examine gender and channel of instruction effect on the performance of participants within the groups. It was revealed that there is a statistically significant interaction effect (p=.003) with an effect size of .065 and a main effect for the groups (p=.000) with an effect size of .294. However, there is no statistically significant main effect for gender (p=.570). It was concluded from the study that technology-based instruction, when mixed with the traditional teaching method, becomes effective for teaching and learning of distance education students. It was recommended based on the findings that the management of distance education programme of the University of Cape Coast should mount a training course for both students and teachers on technology usage in education so that technology can be effectively integrated into teaching and learning progressively.

Keywords: Technology, traditional-based instruction, technology-based instruction, blended instruction

Background

Globally, individuals are seeking for education to open doors for a more unbiased social order on the basis that education implants in the young, critical humanitarian standards such as peace, equity and tolerance. Advancement in education is perceived to be critical for the protection of the environmental, sustainable development, participation in democratic political and social processes, and improvement in child and maternal health. In contemporary times, education is gradually becoming the utmost significant contributor to nationwide economic development (Rajesh, Nair & Jalajakumari, 2016). Evidence from previous studies has suggested that investment in education remains one of the utmost significant factors which has contributed to economic growth in both developing and developed nations. Haddad, Sumner and Lindstromt (1990), for instance, indicated that educational expenditure positively contributes to productivity in labour and the economic remuneration to expenditure on education- from the standpoint both the public and private - is high. The authors argued that improvement in accessibility to high quality education is important in

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virtually every middle-income and low-income country. In view of that, most people having full-time job yearn to enroll on distance education programmes as a means of developing themselves despite their busy schedules.

Attempts to distinction between distance learning and distance education have been made. From Filipczak's (1995, p. 111) views distance learning rather than education, as *"getting people - and often video images of people - into the same electronic space so they can help one another learn" or "a system and process that connects students with distributed resources."* Eastmond's (1998) conversely, highlights distance education as the utilisation of electronic or print communications media to convey educational lessons when students and teachers are detached in a particular place and/or time period. According to the Commonwealth of Learning [COL] (2003, p. 13), distance education is the *"condition where students are detached, physically, from the entity providing the education, interacting through writing, (by the use of email, letter, computer or fax conferencing, mail; verbally (using video conferencing, audio conferencing, telephone); or in face-to-face lecture periods"*. It can, therefore, be inferred from the various descriptions that distance learning or education is a method employed by educational providers for students who have the desire to study where and when it is appropriate for them. Thus, students constantly learn in using this educational approach and as such, generally, assist students who need to accomplish other obligations such as family, community, and work (Ohene & Essuman, 2014). In several years back, audiences who were engaged in distance education, were normally adults pursuing progressive training and education on the job, at home, or in the military. These people, thus, had several tasks and were in physical situations which prevented them from attending a regular educational institution. Currently, anybody is a potential distance student and this notion has repercussions for the African globe. According to Ohene and Essuman (2014), empirical studies on distance learning and education in universities in Ghana is inadequate, although extensive studies have been conducted in the other African countries, particularly in the south and east where the concept of distance learning and education long started.

In the international world, distance education is mainly technology-oriented - it is mostly organized "over the internet" where people study and write exams in the comfort of their home. In view of that, Pallof and Pratt (2001, p. 5) argued that technology has become a mediation for Distance Education. In Ghana, however, distance education seems to take a different form. Lectures are organized on evenings and weekends where workers have closed from work and are not occupied. In the University of Cape Coast, for example, lectures are being organized on weekends at various centers in all the regions. Courses are documented in modules, and are taught in at least six face-to-face lesson period every semester by qualified course tutors in all of its centres across the country. The idea of distance education in the University of Cape Coast was conceived in 1992 following the university's quest to meet the need for opportunities for higher learning for many of the country's working population. Its mission was to particularly train more professional teachers for the basic level of Ghana's education, while raising the professional competence of serving personnel in education, industry and commerce for accelerated development.

Distance education is not devoid of some challenges. In their study, Ohene and

Essuman (2014) discovered that distance education students face some instructional, psychological and social challenges. They added that, sometimes, there is delay in the supply of books they use. Adding to that some students are absent minded when in lectures due to fatigue and issues to be attended to at home. From Galusha's (2012) view, distance education students, which mostly comprise of grown-up workers, may be restricted by time as a result of work and by location owing to family or geographic obligations. These problems exist as a result of the mode of instruction used – face-to-face lessons. It is likely that students cannot make meaningful progress or learning without the course tutor being present. This is because students meet course tutors only on weekends and in some cases in two weeks interval. It is, therefore, necessary to integrate technology-based instruction in distance education in the University of Cape Coast and other Ghanaian universities. The use of technology allows students to learn irrespective of the location and at any time that they are free. In addition to that, the skill tutors and students would gain would develop in them higher order skills in solving complex real-world problems (Lim and Hang, 2003). Because over 90% of the DE students are employed, the skill they acquire in the use of technology would be applied in their various workplace which tends to boost productivity and smooth running of businesses. The field of education would also be knowledge driven as more skilled and practically oriented students would be trained.

Several studies have been conducted on the need to integrate technology into teaching and learning of various courses among regular students at all levels of education (e.g., Bransford et al., 2000; Romeo, 2006; Wong et al., 2006; Yelland, 2001). Yelland (2001), for example, revealed in his study that the normal regular education milieu appears to be unsuitable for training students to be industrious in contemporary workplace and society. Yelland, however, failed to show which type of educational instruction is appropriate even though the traditional instruction appears to be unsuitable. Is only technology education suitable to prepare students for productive life or blending technology with traditional education will be appropriate to prepare students for contemporary workplace and society? Wong et al. (2006), in their study, reported that technology plays a supportive role to face-to-face learning and instruction. It appears that these authors believe in blending the traditional teaching method with technological mode of instruction in classroom instruction and learning. This current study, therefore, seeks to examine the efficacies of technology-based instruction in the University of Cape Coast distance education programme. The study makes use of three groups where different treatment was meted out to each group. The treatments are the method of instruction where the traditional, technology and both were used for the groups.

Research Questions

The study was guided by the following research questions:

1. What is the effectiveness of Technology-based instructional in teaching among Distance Education students of the University of Cape Coast?
2. What effect does gender have with regards to the utilisation of Technology-based instructional in teaching and learning among University of Cape Coast Distance Education student?

Methods

Research Design

A between-subject experimental design with three (3) independent groups was utilised. The study covered all University of Cape Coast Distance Education students. Particularly, the study targeted the first year Distance Education students reading degree programmes since they have no experience with regards to learning on the programme.

Participants

A total of 181 participants from three (3) separate programmes were used for the study. This comprise 47.5% of males and 52.5% of females. Even though the participants were from different programmes, they all offer the same core course. This was to prevent diffusion. This ensured that participants from the different groups do not exchange information. Each group was given a different treatment. The treatments which will be given to each group is as follows:

1. The control group consists of 63 participants offering the same programme. With this group, the tutor employed the traditional instructional method in teaching. The medium of instruction will be solely restricted to the student-lecture interaction method and the use of course of modules. There was a face-to-face interaction for 8 weeks.
2. The experimental group I consists of 58 participants from another program. The mode of instruction was solely the use of technology. The mode of instruction for this group was electronic in nature. A platform was created where the students interact over the internet with the tutor. Recorded videos of the tutor teaching on all the topics were given to the students on that platform. This e-learning makes it possible for an interaction between students and tutor irrespective of where they find themselves. Notes and slides will be made available to the students on that platform. There was no face-to-face or physical interaction between the tutor and the students.
3. The experimental group II comprise of 60 participants who were also from a different programme. This group were taught using the blended approach. That is, the traditional and technology-based mode of instruction was used. Apart from making available recorded videos of the tutors teaching, there was face-to-face instruction where the tutor made utilised images and videos through the use of computer and projectors.

Procedure

Three different groups of participants offering different programmes were randomly selected from the numerous programmes run by the University of Cape Coast Distance Education. Participants in each group were informed on the aim of the study and all ethical issues will be taken into consideration. The 3 groups went through a period of instruction per their modality of instruction for 2 months. The groups that meet for face-to-face interaction met only on weeks for 8 times. During this period,

the same topics were treated across the 3 groups after which the participants in all the groups will be assessed. The participants were assessed using a 25 multiple choice items (See Appendix 1). Their score on the test were then recorded. The scores for participants across the groups were entered in SPSS (version 22). The data were screened for errors. The collected was analysed using two-way analysis of variance (ANOVA) in order to address the research questions.

Results

This part shows the analysis of results of the data gathered.

Table 1: *Descriptive Statistics of the Data*

Groups	Sex	N	Mean	Std. Deviation
Traditional-based Instruction	Male	28	13.96	5.95
	Female	35	16.26	3.28
	Total	63	15.24	4.75
Technology-based Instruction	Male	26	14.69	3.33
	Female	32	12.63	3.35
	Total	58	13.55	3.47
Blended Type of Instruction	Male	32	19.72	2.37
	Female	28	18.57	2.52
	Total	60	19.18	2.49

The descriptive statistics, as shown in Table 1, presents the mean scores as well as the standard deviation of participants across the groups. Participants who were given the blended type of instruction had the highest mean score (M=19.18, SD=2.49). This was followed by the participants who received the traditional-based instruction (M=15.24, SD=4.75). Participants who received the technology-based instruction had the least mean score (M=13.55, SD=3.47).

Table 2: *Two-way ANOVA on the Effect of Gender and Channel of Instruction on the Performance of Distance Education students of the University of Cape Coast*

Source	df	Mean Square	F	Sig.	Partial Eta Square
Corrected Model	5	230.996	17.652	.000*	.335
Intercept	1	45696.211	345696.211	.000*	.952
Group	2	477.297	36.47	.000*	.294
Gender	1	4.228	.32	.570	.002
Group*gender	2	79.992	6.11	.003*	.065
Error		175	13.086		
Total	181				
Corrected Total	180				

*significant at .05 level

The Two-way between-groups ANOVA was employed to examine the effect of gender and channel of instruction on the academic performance of distance education

students of the University of Cape Coast. The study participants were categorised into three groups based to the instructional channel (traditional-based, technology-based and blended instruction). The study found a significant interaction effect [F(2,175)=6.11, p=.003] with .065 effect size which was moderate (Table 2). A significant main effect for the groups [F(2, 175)=36.47, p<.05] was found with a very large effect size (partial eta squared=.294). No statistically significant main effect, however, was found for gender [F(1,175)=.32, p=.570].

Table 3: *Post Hoc Analysis of Groups*

Group (I)	Group (J)	Mean Difference (I – J)	Std. Error	Sig.
Blended Instruction	Technology-based	5.63	.67	.000*
	Traditional-based	3.95	.65	.000*
Technology-based	Blended Instruction	-5.63	.67	.000*
	Traditional-based	-1.69	.66	.011*
Traditional-based	Blended Instruction	-3.95	.65	.000*
	Technology-based	1.69	.66	.011*

*significant at .05 level

Fisher's LSD test was used to conduct a post hoc analysis to examine the exact differences existing among the groups. The result indicates that there is statistically significant difference (p=.000) in the scores of participants in the blended instruction group and the technology-based group. Similarly, significant difference (p=.000) exist between the mean scores of participants in the blended instruction group and the traditional-based instruction group. There is also statistically significant difference (p=.011) in mean scores between technology-based group and traditional-based group.

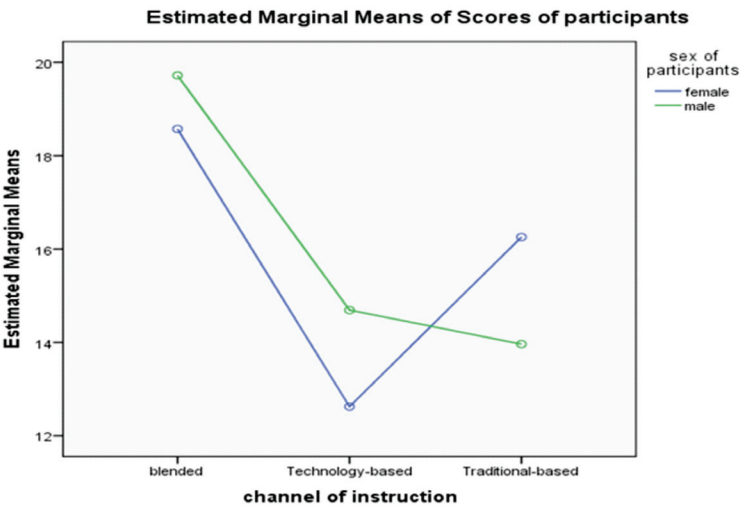

Figure 1: *Graph on Two-way ANOVA*

A simple effect contrast was conducted to examine where exactly the interaction occurred between gender and groups (channel of instruction) (Table 4). The result revealed a significant difference (p<.05) was found among females in all the three groups (i.e., blended type instruction group, technology-based instruction group

and traditional-based instruction group). Again, A significant was revealed among males in Blended and Technology-based (p<.05) and those within Blended and Traditional-based (P<.05). No significant difference was found between males within Technology-based group and those in the Traditional-based (p=.461). Gender differences were discovered within the Technology-based group (p=.032) and Traditional-based group (p=.013). However, no significant difference was revealed between males and females with the blended type instruction group (p=.222).

Table 4: *Simple Effect Contrast*

Contrast	Std. Error	Sig.	95% Confidence Interval	
			Lower bound	Upper bound
Blended vs Technology-based within Female	.936	.000*	4.099	7.794
Blended vs Traditional-based within Female	.917	.013*	.504	4.124
Technology-based vs Traditional-based within Female	.885	.000*	-5.378	-1.886
Blended vs Technology-based within Male	.955	.000*	3.141	6.911
Blended vs Traditional-based within Male	.936	.000*	3.907	7.602
Technology-based vs Traditional-based within Male	.985	.461	-1.216	2.672
Male vs Female within Blended	.936	.222	-2.995	.700
Male vs Female within Technology-based	.955	.032*	-3.952	-.182
Male vs Female within Traditional-based	.917	.013*	.483	4.103

*significant at .05 level

RQ. 1: What is the effectiveness of Technology-based instructional in teaching among University of Cape Coast Distance Education students?

The result shows that participants who were taught using the blended type of instruction (M=19.72, SD=2.49) performed better than participants who taught using traditional-based and technology-based instruction. Similarly, participants who were taught using the traditional-based instruction (M=15.24, SD=4.75) performed better than the participants who were taught using technology-based instruction (M=13.55, SD=4.75).A significant main effect for the groups [F(2, 175)=36.47, p<.05] was found with a very large effect size (partial eta squared=.294).This suggests that the technology-based instruction is effective when blended with the traditional method. This is evident as participants in the group who were taught using the blended type of instruction performed better than those who were taught using the traditional-based and technology-based instruction. However, participants who were taught using the traditional-based instruction did better than those in the technology-based instruction group.

RQ. 2: What effect does gender have with regards to the utilisation of Technology-based instructional in teaching and learning among University of Cape Coast Distance Education students?

No statistically significant main effect was revealed for gender [F(1, 175)=.32, p=.570]. This appears to be misleading as a result of the interaction effect. Significant differences between male and female participants were found with the technology instruction group (p=.032) and the traditional instruction group (p=.013). In the traditional instruction group, female participants (M=16.26, SD=3.28) performed

significantly better than the males (M=13.96, SD=5.96). Male participants (M=14.69, SD=3.33) in the technology instruction group, however, performed significantly better than the females (M=12.63, SD=3.35). No gender difference was discovered in the blended type instruction category (p=.222).

Discussions

Technology use in education in the 21st century, indeed, promotes effective learning and instruction. The effectiveness of learning and instruction is seen in the academic achievement of students. The findings of this study suggest that effectiveness of technology-based instruction in the distance education programme of the University of Cape Coast is seen when it is blended with the traditional-based instruction. This is evident as participants who were taught using the blended type of instruction performed significantly better than those who were taught using only technology and traditional method of instruction. It appears that the use of both traditional-based and technology-based instruction is advantageous as each student benefit from the type of instruction which best suit their learning. In other words, students can go by the method of instruction which they are comfortable with as they also try to learn from the other method which they have little or no control over. This can explain the reason why participants in the blended instruction group performed significantly better than the other participants. This confirms the finding of Wong et al. (2006) who reported that the use of technology plays a significant and supportive role in face-to-face instruction and learning. This has implications for the use of both traditional and technology-based instruction in the teaching and learning of distance students of the University of Cape Coast.

The findings in this study show that technology-based instruction alone appears to be ineffective. This is seen in the result as students in the technology-based group performed poorly than students who were taught using the traditional method of instruction. This trend of result can be ascribed to the idea that students who were taught using the technology-based instruction are new to the method of instruction. In view of that it might take some time for them to adjust to the instructional method. Beside most of the students on distance education programme are grown up and have gone through their levels of education being taught using the traditional method of instruction. This makes it clear why students in both the traditional-based group and blended instruction group performed significantly better than those in the technology-based group. Yelland (2001), however, revealed that the normal regular education milieu appears to be unsuitable for training students to be industrious in contemporary workplace and society. It is clear that blending the traditional and technology-based instruction would help to prepare students to face the world in this 21st century.

Although the result revealed no statistically significant effect with gender, it seems suggests that male distance education students of the University of Cape Coast perform when technology is utilised for learning and instruction. This is seen in the findings as male students performed better when the technology-based instruction was used. On the contrary, the female students also did very well as compared to the males when the traditional-based instruction was used for teaching and learning. This has implications for the use of a particular instructional technique for a class dominated by either males or females. In the blended instruction group, difference in

performance between male and female participants was not significant. This suggests that both category of individuals benefited from the mode of instruction (blending both traditional instruction with technology instruction). It is also likely that the male participants within the blended instruction group effectively utilised the technology aspect whereas the females effectively utilised the traditional instruction. This might lead to the better performance of both the male and female participants.

Conclusion and Recommendations

It can be concluded from the study that technology-based instruction when mixed with the traditional teaching method becomes effective for teaching and learning of distance education students. Even though, using the solely the technology-based instruction in teaching and learning is not suitable for distance education students per the findings, it is believed that it can be very effective when teachers and students are knowledge in the utilisation of technology in learning and instruction. It is, therefore, likely that if teachers and students of distance education are trained in the utilisation of technology in learning and instruction, students would have effective distance education (teaching and learning) in the comfort of their home and thus be prepared for the world of work. This would help reduce the challenges distance education student face in terms of travelling to centers on specific days for lectures. The use of technology in distance education would help distance education students to learn at their own convenience. It appears from the result of this study that male students of distance education performed better when technology is used in giving instruction.

The study recommends, based on the findings, that the governing body of distance education programme of the University of Cape Coast should mount a training course for both students and teachers on technology usage in education so that technology can be effectively integrated into teaching and learning as time pass-by. Again, there is the need for technology to be utilised in learning and instruction in Senior High Schools in the country. Further studies should concentrate on distance education in the other universities within the country.

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Appendix

Appendix 1
Achievement Test in Research Methods in Education

Index Number…….

Time allowed: 30 minutes

INSTRUCTIONS: *Answer all questions. Circle the letter of the correct or best answer.*

1. The type of research which generates theoretical understanding is known as ……research.
   a. action
   b. applied
   c. basic
   d. scientific
2. Which one of the following methods of knowing Limits subjectivity in its enquiry?
   a. Authority
   b. Personal experience
   c. Tradition
   d. Scientific
3. The main motive for conducting research in education is to……
   a. aid educationalists in searching for information.
   b. gather information about a phenomenon.
   c. help students to carry out their research works.
   d. help understand some phenomenon of interest.
4. Which of the following statements is NOT true about research?
   a. Every research process ends in the identification of another problem
   b. Research begins with a topic which is of interest to the researcher
   c. Research deals with the main problem through sub-problems
   d. The problem of any research is the heart of the research process
5. All the following statements are true about action research except…….
   a. Action research aims to provide immediate solution to specific problems.
   b. Action research seeks to raise awareness of issues in a particular area.
   c. It is not concerned with learning about why certain things are done.
   d. Participants in action research passively take part in the research process.

Read the following passage and use it to answer Questions 6 to 8.

Mr. Mensah decides to investigate how the use of instructional materials affects the academic achievement of Lower primary pupils in OLA basic school. He used two classes where he taught one class with materials and the other class without any material. He later gave them a test and recorded the scores of all the participants.

6. The academic achievement of the pupils in Mr. Mensah's study is a/an……variable.
   a. dependent
   b. independent
   c. intervening
   d. quantitative

8. If Mr. Mensah decides to categorise the instructional materials used into two - traditional and modern materials – to see how each of them affect their achievement, the instructional material becomes a/an…… variable.
   a. categorical
   b. dependent
   c. independent
   d. intervening

9. Academic achievement in Mr. Mensah's study is on which scale of measurement?
   a. Interval
   b. Nominal
   c. Ordinal
   d. Ratio

10. An intervening variable can take the form of (a/an) …….
    a. dependent variable only.
    b. independent variable only.
    c. (a) and (b)
    d. none of the above.

11. The main difference between nominal and ordinal scale of measurement is…….
    a. nominal scale categorises and ranks objects.
    b. ordinal scale categorises and ranks objects.
    c. nominal scale ranks categorised objects.
    d. ordinal scale only ranks but do not categorise objects.

12. The research problem is very important in the research process because it……
    a. drives the research process.
    b. is part of the research process
    c. motivates the researcher.
    d. none of the above.

13. Which of the following is NOT a characteristic of research problem?
    a. It should be clear and unambiguously stated
    b. It should communicate the purpose of the study
    c. It should show the relationship between variables
    d. It should represent a moral or ethical position

14. An educated guess about the answer to a question is termed as research……
    a. hypothesis
    b. problem
    c. question
    d. statement

15. A research problem is said to be researchable when…….
    a. information gathering is easy and quick
    b. it does not lend itself to easy scientific study
    c. it is possible to collect data to answer questions asked
    d. it is likely to give a straight answer to the questions

16. Research problem can originate from the following sources except……
    a. experience
    b. professionals
    c. literature
    d. none of the above

17. All the following are importance of hypotheses in research except……
    a. It gives direction to the study
    b. It helps in the designing of the instrument
    c. It helps to confirm or disconfirm a theory
    d. It provides direction for stating the problem

18. What differentiates directional hypothesis from non-directional hypothesis is the fact that non-directional hypothesis only….....
    a. predicts the existence of the effect
    b. specifies the direction of the effect
    c. specifies the type of effect existing
    d. stipulates the nature of the effect

19. In conducting her study, Joana stated her hypothesis as "there is no difference in the performance of day and boarding students in SHS". Statistically her hypothesis is a ……. hypothesis.
    a. directional
    b. non-directional
    c. null
    d. working

20. Ama captured a definition by Adam Smith in her Economics textbook when writing her literature review. The information she picked is which source of data?
    a. Literature source
    b. Primary source
    c. Secondary source
    d. Textbook source

21. Which of the following statements is true about primary source of data?
    a. They are useful in providing bibliography
    b. They give first-hand information
    c. They provide insufficient details on literature
    d. They tend to distort actual information

22. A researchers overall plan for conducting a study is known as a research ……..
    a. design
    b. method
    c. methodology
    d. plan

23. Which of the following conditions do NOT guarantee the use of descriptive research design?
    a. When the researcher is interested in studying variables as they are
    b. When the study requires no manipulation of variables by the researcher
    c. When the study being conducted involves manipulation of variables
    d. When the purpose of the study is to observe and describe natural phenomenon

24. The difference between probability sampling and non-probability sampling is that, in probability sampling…….
    a. participant have unequal chance of being selected.
    b. selection is unbiased in the sampling process.
    c. the researcher is not interested in generalization.
    d. the sample size do not reflect the population.

25. Which of the type of probabilistic sampling techniques is used when the population is divided into sub-groups and participants are select from each group to form the sample for the study?
    a. Cluster sampling
    b. Stratified sampling
    c. Systematic sampling
    d. Both cluster and stratified

26. Mr. Ansah is interested in studying the life style of people who are on drugs (i.e. cocaine and marijuana). Which type of sampling technique is suitable for Mr. Ansah's study?
    a. Convenient
    b. Purposive
    c. Snowball
    d. Systematic

End of Test