Effect of Blended Information and Communication Technology on the Interest of Junior Secondary School Students in Basic Science and Technology for Sustainable Development

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ABSTRACT
The effect of blended information and communication technology on the interest of junior secondary school students in basic science and technology for sustainable development is the main concern of the study. The researchers adopted a quasi- experimental research design, precisely, pre-test, post-test non equivalent group design which involved groups of students in their intact classes. The population for the study was 195 J.S.S II Basic Science and Technology students in the technical colleges in Minna Niger state. Two research questions and three null hypotheses tested at 0.05 level of significance guided the study\The instruments used for data collection was the Basic science and technology. The BSTII, training manual, Blended if lesson plans were all subjected to face and content validation by three experts. The trial test for determining the coefficient of internal consistency of the BSTII items was carried out using Cronbach Alpha. The reliability coefficient computed for the BSTII was 0.85. Mean was used to answer the research questions, while ANCOVA was employed to test the hypotheses. The study revealed that both blended ICT and lecture method stimulate students' interest but that the blended ICT instructional technique was more effective in stimulating students' interest than the lecture method in basic science and technology. The study also revealed that there was effect of gender on students' interest in basic science and technology favouring boys. There were no interaction effects of treatments and gender on interest of JSS students in basic science and technology. Thus the effectiveness of guided inquiry instructional technique on students' interest in auto mechanic was independent of gender. It was thereafter recommended that Ministries of Education, National Science and Technical School Board (NSTSB) should organize workshops, seminars and conferences for basic science and technology teachers on regular basis to enlighten and improve their knowledge and skills on the use of the blended ICT techniques among other recommendations. This is with a view to stimulate student's interest and thus encourage recruits

Keywords: Interest, Junior secondary school, basic science and technology, Blended learning, Information and Communication Technology Sustainable Development

Introduction

Education is one of the sectors that most benefited from the current technological advancement. With this development, time and space are no more barrier to education. As a matter of fact, the concept of distance learning has been revolutionized to what is now known as e-learning or Web-based learning programs. However, it has been observed that the first generation of e-learning programs focused on presenting physical classroom-based instructional content over the internet with very little attention given to the

peculiar nature of this delivery program in comparison to the tradition classroom lesson (Badrul, 2011). This observation has lead educators and researcher to realize that the two approaches are structurally different and so direct translation of traditional material to online will in no way yield a successful program. In addition, learning styles of each learner tend to be different, and hence, "a single mode of instructional delivery may not provide sufficient choices, engagement, social contact, relevance, and context needed to facilitate successful learning and performance" Downes (2010). An attempt to accommodate all these realized challenges is what lead to what come to be known as blended learning or blended e-learning. According to Singh,

> Blended learning mixes various event-based activities, including face-to-face classrooms, live e-learning, and self-paced learning. This often is a mix of traditional instructor-led training, synchronous online conferencing or training, asynchronous self-paced study (Wang, 2011).

Originally, blended learning according to Singh was often associated with simply linking traditional classroom training to e-learning activities; however, the term has now evolved to encompass a much richer set of learning strategies or dimensions. It is the combination of two or more of these dimensions that is today referred to as a blended learning. For a more detailed description of blended learning concept and it theoretical framework, one can see Gulbahar&Madran (2009).

The rapid development of information and communication technology (ICT) and the move towards a robust knowledge-intensive and globalized society have created new challenges on the instructional design model and pedagogy in the tertiary institutions Jarvis (2012). The recant development and awareness of the Nigerian government on ICT have opened various opportunities to adopt e-learning tools towards delivery of Distance Education for its populace, a typical case of the National Open University of Nigeria (Kim, Bonk &Teng, 2009). Tertiary institutions in Nigeria have begun to develop blended e-learning approaches on their conventional programme of studies to link-up with the current trends of globalization in the Education system (Abramovitz, Bererman&Shvartsms, 2012). This is ideally seen in the perspective of open and distance learning, as various tertiary institutions in Nigeria collaborates with other contemporary universities to develop and harness the product of Information and Communication Technology (Hair, Black, Babin& Anderson, 2010). These perceptions are reinforced through reforms on ICT with initiates such as National Policy on Computer Education, National Policy on Information Technology, National Information Technology Development Agency (NITDA), National Space Research and Development Agency (NASRDA), National Communication Commission (NCC), and private telecommunication companies/firm such as MTN, Zain and Etisalat.

However, in spite of e-learning potentials to increasing institutional reputations, it improves the quality of teaching and learning of mathematics, and provides more flexibility in students learning. In addition, the blended approaches help lecturers to save time and allow more attention to be given to the content of the course. Blended e-learning contains best practices of e-learning and face-to-face learning which could overcome the challenges in conventional teaching and learning of mathematics. Ayanda, Eludiora, Amassoma&Ashiru (2011) maintain that, e-learning application ensures that teaching and learning are information and communication technology based, and it has the following benefits:

1) Enable students to have equal opportunities with their contemporaries in other part of the world.
2) Could be used to introduce an interesting variety of the inventory of instructional materials.
3) Exposes students and teachers to basic skills in Computer Education for the purpose of accessing the internet and sourcing of information for effective learning.
4) Helps teachers and students to be comfortably entrenched in the global village.
5) Exposes the teachers and learners to instructional best practices in information technology.
6) Facilitate teaching, knowledge creation and dissemination of information in the tertiary institution

Science and Technology Education is a process of teaching ortraining especially, in school to improve one's knowledge about environment and to develop one's skill of systematic inquiry as well as natural attitudinal characteristics. Science and technology education has beenrecognized worldwide as a pre-requisite in technological development. Science and technology education involvesthe study of science

in depth and in addition, educational knowledge and concepts are learnt andverified. No country can be globally recognized without talking about its scientific advancements.

According to Lewis (2016) science and technology education identifies natural phenomena appropriate to child interest and skills. Science and technology education also equips teachers, learners and the society with knowledge, skills, equipment and freedom to perform noble task useful for improving socioeconomic standard. In addition he added that science and technology education courses are designed to producecapable scientists who contribute meaningfully to academic excellence of the society to raise theeconomic level of nations.

Despite the importance of science and technology education to national development, Nigeria lackedsustainable science and technology education since its independence and as a result, science and technology education has not been able to move the country into industrialization and above poverty level. According to Momeke (2016), science and technology education has failed to produce skilled human resources needed for transformationinto national prosperity. This implies that most of Nigeria's development in the direction ofmodernization has been haphazard leading to acquisition of obsolete technology. Sustainable science and technology education development therefore represents a catalytic process for social educational,training and public awareness – the values, behaviour and lifestyles required for a sustainablefuture.

Research Questions

The following research questions were possed to guide this study:

1. What is the effect of blended ICT techniques on students' interest in studying basic science and technology?
2. What is the effect of Gender on the interest of students (male and female) when taught basic science and technology with the blended ICT?

Hypotheses

The following null hypotheses were formulated to guide the study and was tested at .05 level of significance: Hoi There will be no significant difference between the effect of treatments (blended ICT techniques) on students mean interest scores in BS&T interest inventory.

HO_2: There will be no significant difference between the effect of gender (male and female) on students mean interest scores in BS&T interest inventory.

HO_3: There will be no significant interaction effect of treatments given to students taught with blended ICT techniques and their gender with respect to their mean scores on the interest inventory

II. Methodology

A quasi-experimental design with a pre-test and post- non-equivalent comparison group design was adopted. This design was considered suitable to conduct this study because intact classes (non-randomized groups) were assigned to blended ICT techniques as there was no plan to disrupt the schools' calendar.

The study was carried out in Niger State, Nigeria. The sample size for this study was all the 864 year II basic science and technology students in the four JSS offering basic science and technologyin Niger state. These comprised 160 male and 35 female students. The reason for choosing year II classes is that the students have undergone the curriculum of basic science and technology in their year I and they could respond to the test items. Secondly, the major practical topics in motor vehicle mechanic work curriculum are in the second year The simple random sampling technique was adopted for randomly assigning the four schools that offers basic science and technology to both experimental groups in the study. The four JSS offering basic science and technology and their corresponding student population are Government Day Secondary School, Minna, Bosso Secondary School, Minna, Government Secondary School, Minna, Maryam Babangida Girls Science College, Minna

Instrument for Data Collection

The instrument used for data collection in this study was the Basic Science and Technology (BSTII). The Basic Science and Technology Interest Inventory (BSTII) was developed by the researcher for the

purpose of testing students' interest in basic science and technology. The face and content validities were determined by experts in basic science and technology.

The experts were specifically requested to examine the BSTII items with respect to the extent to which the statements in the BSTII assess interest in the units of study. The suitability of the language used in the BSTII with respect to the students' level of study and the extent of relationship between the BSTII items and the student experiences in units of study. Following the face and content validation, the items were reviewed based on their comments, and thirty statements made up of 15 positive and 15 negative items were finally chosen to constitute the BSTII. Thus Section A of the questionnaire contains items pertaining to the respondents' Bio data while section B contains the list of the thirty items based on five-point Likert scale of Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (D) and Strongly Disagree (SD). Students are to respond to the items according to the level of agreement with each of them

The blended ICT technique lesson plans were also developed by the researcher for the use of teaching the experimental groups. The instructional procedure showed details of the steps, content development, students' and teachers' activities. The lesson plans were also validated by three experts in the department of Industrial and Technology Education&Science Education in the School of Science and Technology of Education, Federal University of Technology, Minna. The experts were specifically requested to examine the extent to which the lesson plans conform to the theoretical blended ICT teaching method. Also, two basic science and technology teachers took part in the validation of the lesson plans. The teachers were specifically requested to examine the lesson plans with respect to the extent to which:

1. The lessons covered the units of study
2. The lesson objectives were clearly stated
3. The objectives were appropriate for the students' level of study
4. Appropriate instructional materials were specified.
5. The evaluation questions were intimately related to the contents and lesson objectives.

The comments of both the experts and teachers were later used in rewriting the lesson plans.
Cronbach Alpha was used to determine the internal consistency of the BSST Interest Inventory items. The BSTII instrument was administered on 30 J.S.S II B.S.S.T students in Government Secondary. School Kontagora, an area which was not part of the study area. The reliability coefficient computed for the Basic Science and Technology Interest Inventory was found to be 0.85. This formula was considered appropriate due to the fact that composite scores of the students on the instrument were required and also that the formula is applicable to items that are not dichotomously scored such as the BSTII.

Experimental Condition

Experimental Bias: The following conditions were laid down to minimize experimental bias: (a) the same lesson topic was taught to both experimental groups: (b) the same achievement test was given to both groups at the same time in order to avoid experimental bias :(c) the students had no pre knowledge of their involvement in the experiment: (d) the researchers were not directly involved in the test administration.

Teacher Variability: All lesson plan used for the study was prepared by the researchers in order to control invalidity that could be coursed by teacher variability.

Training of Teachers: A two -week intensive training was organized for the participating teacher by the researchers on the use of the blended ICT instructional techniques and their lesson plans

The experimental group taught with the use of the blended ICT technique was provided with probing questions or problems alongside complete step by step process or procedures that students followed in order to find or arrive at solutions to the problems. On the other hand, the experimental group taught with the guided inquiry teaching technique was not provided with complete procedural steps (as in the structured inquiry technique) for solving the problems. Rather, the teacher provided the problems to be solved and the explanation of the principle of operation to the students in addition to the provision of the practical materials needed to arrive at solutions. Students were expected to figure out the procedures or steps needed to solve the problems posed. Teachers were also at hand to attend to students' needs where necessary.

The data obtained from the students' scores were analyzed using mean for answering research questions and analysis of covariance (ANCOVA) to test the hypotheses of no significant difference

Result

The results of data analysed in this study are as follows

Research Question 1

.What is the effect of blended ICT techniques on students' interest in studying basic science and technology?

To answer the research question 1, the pre-test and post-test mean values were determined in respect of blended ICT. The results are presented in table 1

Table 1: - *Mean of Interest Inventory Scores of BS&T students taught with blended ICT*

Test	Blended ICT			
	Exp. Group		Control Group	
	n	*Mean*	N	*Mean*
Pre-test	94	97.98	101	99.21
Post-test	94	136.53	101	136.34
Mean gain score		38.55		37.13

Table 1 shows that the treatment group taught basic science and technology with blended ICT technique had a mean interest score of 97.98 in the pretest and a mean interest score of 136.53 in the posttest making a posttest mean gain in the treatment group taught with blended ICT to be 38.55. The treatment group taught basic science and technology with lecture method had a mean interest score of 99.21 in the pretest and a posttest mean of 136.34 with a posttest mean gain of 37.13. With these results, both blended ICT and structured inquiry technique are effective in stimulating students' interest in basic science and technology but the effect of blended ICT on students' interest in basic science and technology is higher than the effect of lecture method.

Research Question 2

What is the effect of Gender on the interest of students (male and female) taught basic science and technology with inquiry techniques?

To answer the research question 2, the pre-test and post-test mean values of male and female students were determined in respect of blended ICT and lecture method. The results are presented in table 2

Table 2 - Mean of Interest Inventory scores of BS&T students taught with Blended ICT

	Blended ICT Techniques							
	Exp. Group				Control Group			
Gender	n	*Mean* Pretest X	Posttest	*Gain*	n	*Mean* Pretest X	Posttest	*Gain*
Male	74	98.28	136.86	38.58	86	99.04	136.48	37.44
Female	20	96.90	135.30	38.40	15	100.20	135.53	35.33

The data presented in Table 2 shows that male students taught basic science and technology with blended ICT had a mean score of 98.28 in the pretest and a mean score of 136.86 in the posttest making a posttest mean gain in the male students taught with blended ICT to be 38.58. Meanwhile, female students taught basic science and technology with blended ICT had a mean score of 96.90 in the pretest and a posttest mean of 135.30 with a posttest mean gain of 38.40 Also, male students taught with lecture method had a mean score of 99.04 in the pretest and a mean score of 136.48 in theposttest making a posttest mean gain in the male students taught with lecture method to be 37.44 Meanwhile, female students taught basic science and technology with lecture method had a mean score of 100.20 in the pretest and a posttest mean of

135.53 with a posttest mean gain of 35.33. With these results male students taught basic science and technology with blended ICT had higher mean scores than female students in the basic science and technology (BSTII). Thus, there is an effect attributable to gender on the interest of students taught basic science and technology with lecture method.

Hypotheses

HO_1: There will be no significant difference between the effect of treatments (blended ICT and lecture methods) on students mean interest scores in BS&T interest inventory

HO_2:There will be no significant difference between the effect of gender (male and female) on studentsmean interest scores in BS&T interest inventory

HO_3:There will be no significant interaction effect of treatments given to students taught with blended learning and their gender with respect to their mean scores on the interest inventory

Table 3 - Summary of Analysis of Covariance (ANCOVA) for Test of Significance of Three Effects: Treatments Gender and Interaction of Treatment and Gender on Students ' Interest in BS&T

Source'of Variation	Sum of Squares	Df	Mean Square	F	Sig of F
Covariates	8.83	1	8.83	1.28	.26
Pre-test	8.83	1	8.83	1.28	.26
Effects	44.17	2	22.08	3.20	.04
Treatment	.50	1	.50	.07	.79
Gender	44.14	1	44.14	6.40	.01
2-way Interactions	2.14	1	2.14	.31	.58
Treatment*Gender	2.14	1	2.14	.31	.58
Explained	60.61	4	15.15	2.20	.07
Residual	1311.21	190	6.90		
TOTAL	1371.82	194	7.07		

***Significant at sig of F<.05**

Table 3 shows F-calculated for three effects: treatment, gender and interaction of treatment and gender on students' interest in basic science and technology. The F-calculated value for treatment is .07 with a significance of F at .79 which is greater than .05. Hence, the null hypothesis of no significant difference between the effect of treatments (lecture method and blended ICT) on students' interest in basic science and technology is upheld at .05 level of significance. The F-calculated for gender stood at 6.40 with a significance of F at .01 which is less than .05. The null-hypothesis is therefore rejected at .05 level of significance. With this result there is a significant effect of gender (male and female) on students' interest in basic science and technology. The interaction effect of treatment and gender has F-calculated value of .31 with significance of F of .58 which is greater than .05. This result means that there is no significant interaction effect of treatments given to students taught basic science and technology with lecture method and blended learning and their gender with respect to their mean scores in the Interest Inventory.

Findings of the Study

The following findings emerged from the study based on the data collected and analyzed and hypotheses tested

1. There was no significant difference between the effect of treatments (lecturemethod blended ICT) on students' interest in basic science and technology.
2. There was a significant effect of gender (male and female) on students' interest in basic science and technology.
3. There was no significant interaction effect of treatments given to students taught basic science and technology with blended ICT and their gender with respect to their mean scores in the Interest Inventory.

Discussion of findings

The data presented in Table 1 provided answer to research question one. Finding revealed that both lecture method and blended ICT are effective in improving students' interest in basic science and technology but the effect of Blended ICT on students' interest in basic science and technology is higher than the effect of

lecture method techniques. This finding indicates that Blended ICT is more effective in stimulating students' interest in basic science and technology than the lecture method. However, the Analysis of covariance of the treatments effects on interest presented in Table 3 showed that there was no significant difference between the effects of treatments (Lecture method and blended ICT) on students' interest in basic science and technology. Thus, the difference between the Blended ICTand lecture method technique on students' interest in basic science and technology was not found significant. The lack of differences between the groups may be because in both research groups the process involves practical work. Hung (2014) assumed that students' practical, outdoor or field work helped them develop responsibility and a sense of caring for the environment. This finding is in agreement with previous research that reports outdoor learning is popular with students (Awodele, Kuyoro, Adejumobi, Awe &Makanju, 2011), raises curiosity (Adu, Eze, Salako&Nyangechi, 2013), and engenders fun (Wang, 2011). Although there was no overall significant difference between the groups, guided inquiry students planned their project, and they were exposed to change and expressed anticipation (Mendez & Gonzalez, 2011), whereas lecture method students were led by the teacher, thus they were less exposed to change, more passive than their guided inquiry peers, and did not express feelings of anticipation. Without anticipation, there is often no disappointment and no surprise (Lopez-Perez, Perez-Lopez & Rodriguez-Ariza, 2011).

Furthermore, another salient finding from this study is that it was found that male students taught basic science and technology with ICT had higher mean scores than female students in the Motor mechanic Interest Inventory, revealing that there is an effect attributable to gender on the interest of students taught basic science and technology with ICT techniques. However, analysis of covariance of test of significant difference between the effect of gender on students' interest in basic science and technology as presented in Table 3 showed that there was no significant difference between the effect of gender (male and female) on students' interest in basic science and technology. This means that the observed difference in the mean interest scores of male and female students was not statistically significant. Interestingly, providing of opportunities to interact with course material through the use of appropriate real live, tools and equipment cooperatively tends to change the course from a competitive endeavour to one that is more student-centred, and focused on the construction of knowledge in the students (Hung, 2014). Hence, one means of constructing knowledge is to create meaning by doing. Creating support for knowledge construction within the students is a critical component to the success of developing self-motivated, intellectually stimulated learners (Downes, 2010). The obvious implication of the use of appropriate real live components, tools and equipment therefore, is to facilitate students' interaction with the learning environment. This will help to sustain students' interest which increases the strength of ego-involvement of the learners and which does not allow the learners to be,, distracted by trivial extraneous events in the perceptual environment.

Analysis of covariance was used to test hypothesis 3, Table 3, at the calculated F-value (.31), significance of F (.58) and confidence level of .05, the interaction effect of treatment and gender was not found to be significant. This implies that the effectiveness of Blended ICT on students' interest in basic science and technology is independent of gender.

IV. Conclusion and Recommendation

The influence of technological advancement in basic science and technology has rendered traditional skills inadequate for work in the education industry. This advancement in technology has created the need for new and often sophisticated skills. Obviously, the education industry needs the service of Basic Science and Technology that can adapt to the changes in technology in the industry. Greater stress need therefore be placed on providing students with broad learning and problem-solving skills in order to prepare them for a wide range of challenges posed by technological advancement which has occasioned the need to seek for alternative instructional method such as blended ICT to teach the modem work place skills requirements of the industry. Moreover, it has been discovered that the persistent poor academic achievement and low interest of students in Basic Science and Technology in Junior Secondary Schoolsis as a result of the inappropriate teaching methods adopted by teachers (Aina, 2000). The need to find the appropriate teaching technique to assist Basic Science and Technology students to learn basic science and technology and naturally increase students' interest, involvement and commitment in learning, is the focus of the study.

Based on the findings of this study, the following recommendations are made:

1. Science and technology teachers of Basic Science and Technology should adopt the use of Blended ICT technique to the teaching of Basic Science and Technology, in such a way that students are allowed ample opportunity to interact freely with one another in the Blended ICT so as to increase students interest in basic science and technology and invariably improve both their psychomotor and cognitive achievement
2. Workshops, seminars and conferences should be organized by Ministry of Education, Science and Technical School Board to enlighten science and technology teachers and improve their knowledge and skills on the use of Blended ICT for improving students' interest in education generally and basic science and technology in particular.

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