EFFECT OF COMPUTER SPREADSHEET ON SECONDARY SCHOOL STUDENTS' ACHIEVEMENT AND INTEREST IN BASIC STATISTICS

BY

DR. M.N.O.V. EZEAMENYI
AND
NNEJI, SAMUEL ONYINYECHI

DEPARTMENT OF SCIENCE AND COMPUTER EDUCATION,
FACULTY OF EDUCATION
ENUGU STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY (ESUT),
ENUGU.

Abstract

This study specifically was to investigate the effect of computer spreadsheet strategy on senior secondary school one (SSI) students' achievement and interest in basic statistics and the interaction between teaching strategies and location of schools on SSI students' achievement and interest in basic statistics. Four research questions and six hypotheses guided the study. Quasi-experimental design was adopted, precisely it was a pretest – posttest control group design where intact classes were used. Experimental groups were taught with computer spreadsheet strategy while the control groups were taught with expository method. Sample for the study consisted of 261 SS 1 students made up of 133 urban and 128 rural students. Also 128 students were in the experimental group and 133 students in the control group. Instruments used for data collection were mathematics Achievement Test (MAT) and Mathematics Interest Scale (MIS) developed by the researchers and validated by three research experts. MAT yielded a reliability coefficient of.93 using Kuder Richardson's formula 20 (KR-20) while MIS yielded a reliability coefficient of .83 using the Cronbach's Alpha method. Mean and standard deviation were used to answer the research questions while Analysis of covariance (ANCOVA) was used to test the hypotheses at .05 significance level. The study revealed that the students taught with computer spreadsheet strategy attained higher achievement and also showed greater interest in mathematics. No significant interaction existed between teaching strategies and school location with regard to students' achievement and interest in basic statistics . It was recommended that secondary school mathematics teachers be trained and supported to used computer spreadsheet strategy in teaching basic statistics.

Introduction

The federal government of Nigeria in realization of the importance of education in achieving the nation's national development plan, articulated laudable goals for secondary education. One of the goals of secondary education as stated in the National Policy on Education 2004 is to provide trained manpower in the applied sciences, technology and commerce at sub-professional grades. It is only a functional educational system that can achieve this laudable goal and no meaningful educational system can underrate the vital role of mathematics. Encarta Encyclopedia (2005) defined mathematics as the study of relations

among quantities, magnitudes and properties and of logical operations by which unknown quantities, magnitudes, and properties might be deduced. Thus, mathematics does not only use numbers but it also uses the properties of those numbers and the operations on these numbers to describe phenomena, hence, facilitating reasoning and helping us to visualize the relationship between objects and processes. Mathematics gives us a fuller understanding of the world around us and this understanding can be applied to solving our day to day problems. Variously, mathematics have been described as "the most perfect of all sciences" (Lakatos, 1986), "the mother of all sciences" (Mura, 1995), "the queen of all sciences (McGinnis, et al, 1996), "a science in its own right" (Mura 1995) while Ihejieta (1989) in Ezenwani (1999) observed that one cannot speak realistically of a sound science curriculum without considering the important role played by mathematics, just as science itself would not have developed in its present stage without mathematics. So it is unrealistic to think that true character of science can be portrayed without mathematical thinking.

It is disheartening that despite the indispensable role of mathematics in realizing Nigeria's scientific and technological aspirations, students at all levels of the educational system, especially secondary school level, fear achieve poorly in mathematics, largely because they still perceive mathematics as abstract. WAEC Chief Examiners' Reports (1999-2003) indicated that candidates achievement in mathematics was generally poor. Researchers have variously implicated teaching method as a major determinant of students' achievement and interest in mathematics. Perhaps, the most popular teaching method in the secondary school system is the expository method. This method also referred to as lecture, conventional or traditional method has come under serious criticisms as a teacher-centred method. Although researchers claim that expository method leaves the learner passive, the method still has its merits especially as it seems to be the most useful for large classes, for faster coverage of large scheme of work and for shorter lesson periods.

However, with the expository method of teaching, the achievement and interest of

students in core subjects such as mathematics continue to depreciate. Hence, the WAEC Chief examiners' report (1992) recommends the use of effective teaching method which is in tune with the modern science and technological dispensation as a major remedy to students' poor achievement and interest in mathematics for senior secondary school examinations. The fast-growing use of computers in almost all fields of life has also influenced science education, Ellis (2002) and Marks (2004) believed that computer animation or computer simulation in particular, has tremendous potential for the enhancement of the teaching and learning of science concepts. From the fore-going, the effect of use of computer spreadsheet as instructional strategy for teaching secondary school mathematics is worth while. More-so, as good as computer assisted instruction strategy may sound, there are contradictory reports on its efficacy in teaching and learning of mathematics. While some researchers reported computer assisted strategies as very effective others reported that it inhibited achievement and interest in mathematics (Ogbu, 2006). Hence, there is no definitive conclusion yet. The problem of this work therefore, put in question form is what is the effect of computer spreadsheet strategy on secondary school students' achievement and interest in Basic Statistics?

Purpose of the Study

The purpose of this study was to investigate the effect of Computer Spreadsheet on senior secondary school I (SSI) students' achievement and interest in Basic Statistics. Specifically, the study investigated the effect of computer spreadsheet on senior secondary school I (SSI) students';

(i) Achievement in basic statistics;
(ii) Interest in basic statistics;
(iii) Achievement in basic statistics with regard to the location of their schools.
(iv) Interest in basic statistics with regard to the location of their schools.

Research Questions

The following research questions guided the investigations:

1. What are the mean mathematics achievement

scores of students in the experimental and control groups in both pretest and posttest?
2. What are the mean mathematics interest scores of students in the experimental and control groups in both pretest and post test?
3. What are the mean mathematics achievement scores of urban and rural schools' students in the experimental and control groups n both pretest and posttest?
4. What are the mean mathematics interest scores of urban and rural schools' students in the experimental and control groups in both pretest and post test?

Hypotheses

The following research hypotheses were tested at .05 level of significance to further validate the research questions;

1. There is no significant difference between the mean mathematics achievement scores of the students in experimental and control groups.
2. There is no significant difference between the mean mathematics interest scores of the students in experimental and control groups.
3. There is no significant difference between the mean mathematics achievement scores of urban and rural schools' students in the experimental and control groups.
4. There is no significant difference between the mean mathematics interest scores of urban and rural schools' students in the experimental and control groups.
5. There is no significant interaction between teaching strategy and school location on students' mean achievement scores in mathematics.
6. There is no significant interaction between teaching strategy and school location on students' mean interest scores in mathematics.

Method

Quasi-experiment pretest – posttestcontrol group design was adopted. Intact classes were used. The classes were assigned randomly to experimental and control groups. Experimental groups were taught selected topics in basic statisties using computer spreadsheet strategy while control groups were taught the same topics using expository method. Area of the study was Enugu South Local Government Area of Enugu State. Sample for the study consisted of 261 SSI students drawn as follows; by purposive sampling technique was used to draw all secondary schools that had functional computer facilities. From these schools, four schools were drawn by random sampling,

two from urban and two from rural areas.

From each school, two intact SSI classes were randomly drawn and randomly assigned to experimental and control groups.

The experimental groups had 128 students while the control groups consisted of 133 students. Similarly, 133 students were from urban schools while 128 were from rural schools. Pretest was administered to both groups before the commencement of the treatment. Treatment was administered for a period a six weeks after which a posttest was administered. Instrument for data collection (posttest and pretest) was Mathematic Achievement Test (MAT) and Mathematic Interest Scale (MIS). The instruments were validated by three research experts from Faculty of Education, Enugu State University of Science and Technology (ESUT) Enugu who confirmed them to have both face and content validity. Using Kuder Richardson 20 (KR-20) formula, a reliability Co-efficient of .93 was obtained for MAT while Cronbch Alpha's method was used to obtain a reliability Co-efficient of .83 for MIS. Data collected were analyzed using mean, standard deviation and Analysis of Covariance (ANCOVA). Specifically, mean with standard deviation was used to answer the research questions while ANCOVA was used to test the hypotheses at .05 level of significance.

Experimental Procedures

The researcher trained the four regular mathematics teachers in the four secondary schools used in the study for a period of two weeks on the use of computer spreadsheet strategy. Fore-most, the MAT and MIS were administered to all the subjects of the study as pre-test. Thereafter, the treatment was administered for a period of six weeks. The experimental group in each school was taught the selected Basic statistics topics using the computer spreadsheet strategy, while the control group in each school was taught the same Basic statistics topics using expository method.

At the expiration of the treatment period, the MAT and MIS were re-arranged and administered to all the subjects as post-test. All the tests administered were scored by the researcher using already made marking scheme. Scores obtained were analyzed using mean, standard deviation and analysis of co-variance.

Results

Research Question One

What are the mean mathematics achievement scores of students in the experimental and control groups in both pretest and posttest?

Table 1: Mean achievement scores and standard deviation of the students in experimental and control groups in pretest and post test.

Group	N	Pretest Mean	SD	Posttest Mean	SD
Experimental	128	33.6	8.5	81.3	3.2
Control	133	32.8	8.2	51.1	9.4

Research Question Two

What are the mean mathematics interest scores of students in the experimental and control groups in both pretest and post test?

Table 2: Mean interest scores and standard deviation of the students in experimental and control groups in pretest and post test

Group	N	Pretest Mean	SD	Posttest Mean	SD
Experimental	128	41.6	11.3	69.7	4.3
Control	133	41.7	10.8	50.1	9.6

Research Question Three

What are the mean mathematics achievement scores of urban and rural schools' students in the experimental and control groups n both pretest and post test?

Table 3: Mean achievement scores and standard deviation of urban and rural students in experimental and control groups in pretest and post test.

Group	N	Pretest Mean	SD	Posttest Mean	SD
Urban (Experimental)	65	31.7	7.4	80.3	4.1
Urban (Control)	68	32.3	9.1	50.4	8.3
Rural (Experimental)	63	32.1	8.2	81.4	4.2
Rural (Control)	65	31.6	9.4	51.2	9.1

Research Question Four
What are the mean mathematics interest scores of urban and rural schools' students in the experimental and control groups in both pretest and post test?

Table 4: Mean interest scores and standard deviation of urban and rural students in experimental and control groups in pretest and post test.

Group	N	Pretest Mean	SD	Posttest Mean	SD
Urban (Experimental)	65	41.05	10.8	68.3	3.6
Urban (Control)	68	40.7	9.6	49.5	8.8
Rural (Experimental)	63	40.8	9.7	68.7	4.1
Rural (Control)	65	41.1	10.2	50.1	9.4

Table 5: ANCOVA analysis of students' mean mathematics achievement scores.

Source of variation	Sum of squares	DF	Mean Squares	F- Calculated	Sig. level	Decision
Covariates	13288.77	1	13288.77	900.970	.000	S
Pre test	13288.77	1	13288.77	900.970	.000	S
Main effect	864.134	2	432.067	29.295	.000	S
Strategies	25.697	1	25.697	1.742	.010	S
Location	835.056	1	835.056	56.619	61.14	NS
2 way Interaction	5.159	1	5.159	.350	1.611	NS
Explained	14157.370	4	3539.343	239.978	0.000	S
Residual	796.426	74	10.763			
Total	**14953.797**	**78**	**192.715**			

S = Significant, NS = Not Significant at .05 level of probability

Table 6: ANCOVA analysis of students' mean mathematics interest scores.

Source of variation	Sum of squares	DF	Mean Squares	F- Calculated	Sig. level	Decision
Covariates	6807.490	1	6807.490	489.258	.000	S
Pre test	6807.490	1	6807.490	489.258	.000	S
Main effect	1259.608	2	629.804	45.264	.000	S
Strategies	1257.197	1	1257.197	90.355	.000	S
Location	1.658	1	1.658	.119	1.016	NS
2 way Interaction	5.177	1	5.177	.372	1.411	NS
Explained	8072.275	4	2018.069	145.040	.000	S
Residual	751.352	74	13.914			
TOTAL	**8823/627**	**78**	**152.132**			

S = Significant, NS = Not Significant at .05 level of probability

Summary of Findings

The results as presented revealed the following:

1. The students taught Basic Statistics with computer spreadsheet showed higher achievement than those taught with expository method.
2. The students of computer spreadsheet strategy showed greater interest towards mathematics than their counterparts who were taught with expository method.
3. There was no significant difference between the mean mathematics achievement scores of urban and rural students taught basic statistics with computer spreadsheet strategy and their counterpart in the expository class.
4. There was no significant difference between the mean mathematics interest scores of urban and rural students taught basic statistics with computer spreadsheet strategy and their counterpart in the expository class.
5. There was no significant interaction between teaching strategies and location of schools on students' achievement and interest in mathematics.

Discussion

On research question one the pre-test mean mathematics achievement score and standard deviation of the experimental group were 33.6 and 8.5 respectively and the post tests were 81.3 and 3.2 respectively. For the control group, the pre-test mean mathematics achievement score and standard deviation were 32.8 and 8.2 respectively while the post test were 51.1 and 9.4 respectively. There was not much difference between the two groups in the pre-test but there was an appreciable difference in the post test.

The experimental group scored much higher with a lower standard deviation of 3.2. Though there was no significant difference in the standard deviation of the both group in the pretest, in the post test the Standard Deviation of control group was higher, indicating existence of more extreme scores. Regarding research question two in the experimental group the pre-test mean mathematics interest score and standard deviation were 41.6 and 11.3 respectively while the post test mean mathematics interest scores and standard deviation were 69.7 and 4.3 respectively. In the control group, the pre-test mean mathematics interest score and standard deviation were 41.7 and 10.8 respectively while the post-test were 50.1 and 9.6 respectively. While there was not much difference between the interest of the two groups before the experiment, the posttest mean mathematics interest scores and standard deviation showed remarkable differences. The experimental group had a higher mean mathematics interest score than the control group.

On research question three above shows that urban students in experimental group had a mean score of 31.7 and 80.3 in pre and post tests respectively while urban students in the control had 32.2 and 50.4 mean scores respectively. Though there was no significant difference in the pretest mean scores of both control and experimental groups, in the post test, urban students in the experimental group far exceeded those in the control group. Similarly, the rural students in the experimental group performed of 81.4 as against 51.2 of the control group, though the pretest means scores of 32.1 and 31.6 respectively were not tangibly different.

Interestingly, in the posttest, the urban experimental and rural experimental groups scored 80.3 and 81.4 respectively. Urban control and rural control groups also scored 50.4 and 51.2 respectively.

Hence no tangible difference existed between the scores of the groups irrespective of the location of their schools.

With respect to research question four above there is no significant difference between the students' interest in the pretest. The urban students scored 41.05 and 40.7 in both experimental and control groups respectively while the rural students scored 40.8 and 41.1 respectively. In the post test the urban students and rural students in experimental groups recorded higher interest mean scores than the control groups with 68.3 and 68.7 respectively as against 49.5 and 50.1 of the urban students and rural students in the control groups. In the post test the genders'
interest mean scores in both groups were not significantly different. Urban students and rural students in the experimental groups had a mean interest scores of 68.3 and 68.7 respectively while urban students and rural students in the control groups had mean interest scores of 49.5 and 50.1 respectively.

Urban experimental achieved a mean interest score of 68.3 and rural experimental also had a mean interest score of 68.7 in the post test. Similarly, urban control had a mean mathematics interest score of 49.5 and rural control had 50.1 in the post test. Obviously, no tangible difference existed.

Result from research question five shows F – calculated of 900.970, 29.295, and 1.742 for pre-test, main effect and strategies respectively with significant effects. For location there is no significant effect with an F – calculated of 56.619. For interaction between strategies and location an F – calculated of .350 equally shows no significant effect.

Hypothesis one is rejected as stated because the difference between the mean achievement scores of the students in experimental and control groups was significant. Contrarily, hypotheses three and five are not rejected because there was no significant difference between the mean achievement scores of urban and rural students in experimental and control groups, hence, no significant interaction between teaching strategies and location of schools on students' achievement in mathematics.

The result in table 6 shows F – calculated of 489.258, 45.264, and 90.355 for pre-test, main effect and strategies respectively with all indicating significant effects. Location and the interaction between strategies and location recorded .119 and 372 respectively showing no-significant effects.

Hypothesis two was rejected as stated because there was a significant difference between mean interest scores of the students in experimental and control groups. But Hypotheses four and hypotheses six are not rejected as stated. This is because there was no significant difference between the mean interest scores of urban and rural students toward mathematics in both groups, and no significant interaction between teaching strategies and location of schools on students' interest in mathematics.

Recommendations:

The following recommendations are deemed necessary:

1. Mathematics teachers should be encouraged to use computer spreadsheet strategy in teaching senior secondary school basic statistics.
2. Government agencies and professional bodies such as Mathematics Association of Nigeria (MAN) and Science Teachers' Association of Nigeria (STAN) should sponsor further researches on the efficacy of other computer assisted strategies.
3. Government should mathematics teachers laptop computers or loans to purchase personal computers.

References

Ajiboye, J.O. (1996) Secondary School students' cognitive and effective outcome of using a self-learning package on some selected population Education concepts. Unpublished Ph.D. Dissertation, University of Ibadan

Akinsola, M.A. (2006). Post *graduate Diploma in Education (PDE) Book 7 (Maths).* Kaduna: National teachers' Institute (NTI). 2

American Association for the Advancement of Science (AAAS) (1993) *Benchmarks for science literacy.* New York: Oxford University press.

Balogun, T.A. (1996) Effect of two science programmes on students' Achievement and Attitude **Journal of research in science teaching.**

Ellis, J.D. 1984. A rational for using Computers in Science Education. The American Biology Teacher. 46,200-206

Eze, A.O.(2002). Effect of Prior Knowledge of Instructional objectives on students'Achievement in senior secondary school mathematics. **Journal of Arts and social science review.**

Ezenweani ,U.L (1999), Relevance of Mathematics on Science and Technical Education in Nigeria Universities. A paper presented at 1st Annual Conference of Faculty of Education, Enugu state University of Science and Technology, Enugu. 1037 - 1041.

Federal Republic of Nigeria (2004) *National Policy on Education:* Abuja NERDC Press.

Microsoft Encarta Encyclopedia (2005) Microsoft corporation USA

Nwosu, P. (1982) *Intermediate mathematics for schools and colleges.* Enugu fourth Dimension publication

Ogbu, S. (2006). Effect of Simulation games on students' achievement and interest in Mathematics. Unpublished M.Sc (Ed) Thesis, Enugu State University of Science and Technology (ESUT), Enugu.

Ozofor, N.M (2001). Effect of two modes of computer aided instruction on students' achievement and interest in statistics and probability University of Nigeria Nsukka

Randy,L.B & Kathy, C.T. (2008). The use of a computer simulation to promote scientific conceptions of moon phases. Journal of research in science teaching 45(3),346-372

Richardson, V. (2003). Constructivist pedagogy. *Teachers College Record, 105, 1623-1640.*

Yosi, R. Ruth, S. & Gili, M. (2008). Using Computer Animation and Illustration Activities to Improve High School students' Achievement in Molecular Genetics. ***Journal of Research in Science Teaching 45, (3) 273-292***