Effects of Computer-Based Instructional Puzzle on Students' Learning Outcomes and Retention in Social Studies

Adedoja, G. O. (Ph.D)
Faculty of Education
Department of Teacher Education
University of Ibadan
Ibadan

Fakokunde, J. B. (Ph.D)
Department of Arts and Social Science Education
Osun State University
Ipetu – Ijesa Campus
Ipetu - Ijesa

Abstract

The study determined the effects of computer-based instructional puzzle on students' learning outcomes and retention in social studies. The study adopted a pretest-posttest and delayed-test quasi-experimental design. Four junior secondary schools were purposively selected within Ilesa metropolis of Osun State. Intact class was used in each of the schools and a total of 141 participants were involved. The instruments for data collection were Students' Attitude towards Social Studies Questionnaire and Social Studies Achievement Test. Three hypotheses were generated and tested at 0.05 level of significant. The result showed that there is a significant main effect of treatment on students' achievement in social studies ($F_{(1,128)} = 162.00$; $P<0.05$). The study further revealed that there is significant main effect of treatment on students' retention in social studies ($F_{(1,128)} = 111.85$; $P<0.05$) with the experimental group on the higher side. Based on the findings, it is recommended that the use of computer-based instructional puzzles should be encouraged coupled with the provision of all the resources needed for proper implementation.

Keywords: Instructional Puzzle, Computer, Learning Outcomes and Retention.

Introduction

The role of social studies in the socio-political and economic advancement of any society makes it relevant as a subject in the school curriculum. According to Mezieobi, Fubara and Meziobi (2008), social studies is an integrative field of study which probes man's symbolic relationship with his environment, endows man with reflective or contemplate capacities, intellectual, affective, social and work skills to enable him understand his world and its problems and to rationally solve or cope with them for effective living in the society. However, students' poor performance in social studies has continued to be a concern to social studies educators. Ayodeji (2009) asserts poor achievement of students in social studies which was also corroborated by the finding of Edozie (2009). Olibie and Ezeoba (2013) acknowledge poor students' academic achievement in social studies which also translates into negative interest and poor academic achievement in related courses such as geography, law and sociology at post secondary school level coupled with inability to apply desirable social and citizenship skills to their daily challenges of living while Edinyang and Ubi (2012) agree to the fact that Nigerian secondary school students achievement in social studies has continued to remain flat or decline. The prevailing poor performance of students in social studies has been attributed to poor instructional strategy which dwells on convention method of instruction that allows the teacher to play a domineering role in instructional delivery with little or no active involvement of the learners [Kazi (1989), Khaled and Chiodo (2004), Yusuf (2004), Orungbemi (2008) citing Maiwada (2004), Ayodeji (2009), Edozie (2009) and Okobia (2012)].

Scholars such as Iyamu and Aduwa-Ogiegbaen (2008), Jimoh and Akindoju (2010) have also identified little or non utilization of educational technology resources by social studies teachers in Nigeria thereby advocating the incorporation of information communication technology (ICT) strategy into social studies classroom. The drive towards relevance in term of information communication technology (ICT) has necessitated the use of computer for instruction at all academic levels. The 2007 computer studies curriculum for junior secondary student 1 to 3 in Nigeria views the computer as a major component of ICT which has singularly and dramatically continued to change the behaviour pattern of people and corporate entities by determining the way they socialise, learn, shop, conduct business, communicate and interact for multi-dimensional mutual reasons. In the view of Lawal and Abdullahi (2002), the computer is an ideal resource for; simulation of science experiment, modeling in economics, graphics in arts and design and assessing a large database in geography, history and geology. Sewell (1990) citing Chandler (1984), asserts that computer-based instructions allow for individualisation of instruction and enhance interactivity which promotes active learning.

Abimbade (2006) posits that technology is changing ones expectation of what students will learn, how and where they will learn it so as to function in the new world order. Different researches have shown the effectiveness of computer-based instruction on academic achievement. The findings of Howland, Laffety and Espinosa (1997), Kimberlee (2010), Mudashiru and Adedeji (2010) have revealed the efficacy of computer-based instruction in facilitating learning. The interactivity and need to align with modern technology have made computer relevant within the educational realm. . However, social studies classroom is still left out in its utilisation. The relevance of educational puzzles in instructional delivery has also been attested to by many researchers. According to Scott (2002), a puzzle is nothing but a problem that is fun to solve. Ackert (2009) advocates the use of puzzles for children of all ages based on their relevance in teaching: shape, colour, letter and word recognition skills, sensory perception, fine motor skills such as grasping and manipulating objects; hand-eye coordination, spatial reasoning; problem solving/reasoning skills; sorting and classifying; organisation skills; self-confidence. Ann (2006) also supports the use of puzzle-based instructional strategy at all educational levels premised on the scholar's experience as educator and availability of puzzles for all ages. Nelson (2011), Michalewicz and Michalewicz (2008) also assert that puzzle-based instructional strategy enhances learning by experience, imitation and reflection.

Falkner, Soriamarthi and Michalewicz (2009) submit that puzzle-based learning assists students by providing a framework to explore critical thinking as well as being fun and interesting. Scott (2002) also posits that puzzle can teach spatial skills, hand-eye coordinating, mathematics, language, social science and science concepts as well as logic and thinking and therefore advocates the use in instructional delivery. The relevance of puzzles in terms of developing critical thinking ability in learners, making learning interactive and fun, make the determination of the effects of instructional puzzle on learning outcomes and retention a worth while effort. For any instructional strategy to be relevant, it must enhance learning outcomes and retention. According to Adams (2004), learning outcomes are concerned with the achievement of the learners rather than the intention of the teacher as expressed in the aims of a module or course. Lim and Morris (2009) identify reinforcement, course relevance, interest, self efficacy, effect and learner as factors influencing learning outcomes. Citing Malone (1981), Lim and Morris (2009) submit that when a learning task is challenging and involves fantasy during the learning process, the learners will be motivated. Oladele (2004) posits that for learning to take place, learners must be actively involved in the learning situation, accept major responsibility for their learning and be allowed to work in a threat free atmosphere. The study of Dale (2011) shows that learning-retention rate is influenced by the learning experiences and the media.

Edwin (2010) opines that to enhance learning, a living atmosphere must be created, learners should be able to work in their pace and practice since practice helps to increase the learning ability of the child. In the view of Owuamanam and Owuamanam (2004), minimal level of anxiety, cues, feedback are needed for effective learning. Ajelabi (2005) identifies readiness, motivation, practice, provision for transfer of knowledge and creating convenient learning environment as factors that can aid learning. Adeyanju (2000) while looking into ways of enhancing learning identifies factors such as motivation, statement of objectives, organisation of content, preparation and use of instructional materials, practice and repetition, feedback, reinforcement and application. The incorporation of features such as repetition, activity, motivation, feedback, certain level of anxiety in puzzle-based instructional strategy make the determination of the effects of computer-based instructional puzzle on learning outcomes and retention relevant since these features could be motivating factors for learners to learn.

The attributes of computer-based instructional puzzles in terms of learner's engagement and reinforcement also make the examination of its effectiveness on learning outcomes and retention relevant.

Statement of the problem

The prevalence of conventional mode of teaching in social studies classroom has resulted in students' decline interest and achievement in the subject in spite of the role of social studies towards the transformation and sustainability of the society. Studies have also revealed the growing interest of students in computer and computer related devices while their reading-habit continues to decline thereby inducing the need to incorporate computer-based strategy into the teaching and learning of social studies so as to facilitate learning through what the students like doing. The effectiveness of puzzle in facilitating active learning and critical thinking ability which could enhance problem solving ability of the learners, thereby making them relevant in the socio-economic and political advancement of their society requires the integration of instructional puzzles into social studies classroom via the computer. This study therefore examined the effects of computer-based self-learning instructional puzzle on students' learning outcomes and retention in social studies.

Hypotheses

Three hypotheses were generated and tested at 0.05 significant level

Ho1. There is no significant main effect of treatment on students' attitude towards social studies

Ho2. There is no significant main effect of treatment on students' achievement in social studies.

Ho3. There is no significant main effect of treatment on students' retention in social studies.

Methodology

This study adopted a pretest-posttest and delayed-test quasi-experimental design. Four schools were purposively selected within Ilesa metropolis in Osun State premised on the availability of qualified social studies teacher and functional computer studies laboratory. Students in two of the selected schools formed the experimental group while the others served as the control group. The experimental group was exposed to computer-based self-learning instructional puzzles for eight weeks based on selected topics from junior secondary school 11 social studies curriculum while conventional method was used in the control group. Intact class was used in each of the schools with a total of 141 participants. Pretest was carried out before the commencement of the treatment and posttest was conducted after the treatment while delayed test was administered in the 3rd week after the posttest.

The instruments for the study were Students' Attitude towards Social Studies Questionnaire (SASSQ) and Social Studies Achievement Test (SSAT). The instruments were given to lecturers in social studies education and social studies teachers at junior secondary school for face and content validity. The instruments were also administered to 25 students in a school that was not included in the study. The students' responses to the SASSQ were subjected to Cronbach alpha analysis and a reliability coefficient of 0.73 was obtained while their scores in the SSAT were subjected to Kuder-Richardson formula (KR 21) and a reliability level of 0.89 was obtained. Data collected at pretest, posttest and delayed-test were analysed using Analysis of Covariance (ANCOVA) to test the hypotheses.

Results

Testing the Null Hypotheses

Ho1: There is no significant main effect of treatment on junior secondary school students' attitude towards social studies.

Table 1: Summary of Analysis of Covariance (ANCOVA) on Students' Attitude towards Social Studies

Source	Type III Sum of Squares	Df	Means Square	F	Sig.	Partial Eta Squared
Corrected Model	1422.203	12	118.517	1.477	.141	.122
Intercept	4344.538	1	4344.538	54.128	.000	.297
PREATT	535.905	1	535.905	6.677	.011	.050
TREATMT	146.164	1	146.164	1.821	.180	.014
Error	10273.768	128	80.264			
Total	513433.000	141				
Corrected Total	11695.972	140				

R Squared = .122 (Adjusted R Squared = .039

Table 1 reveals that there is no significant main effect of treatment on students' attitude towards social studies (F $_{(1,128)}$ = 1.82; P>0.05). Therefore, H_{01} is not rejected. To further examine the attitude of the students across the groups, table 2 showing the magnitude of posttest mean of attitude scores is presented.

Table 2: Estimated Marginal Means on Students' Attitude towards Social Studies

Variable	N	Mean	Std.Error
Pre-score Attitude	141	57.94	-
Post-score Attitude	141	59.89	.83
Treatment			
Control	53	61.02	1.33
Experimental	88	58.76	1.00

Table 2 reveals that students in the control groups have higher attitudinal mean score (61.02) than their counterparts exposed to computer-based self-learning instructional puzzles (58.76). However, the difference between them is not statistically significant and cannot be attributed to the treatment.

Ho2**:** There is no significant main effect of treatment on junior secondary school students' achievement in social studies.

Table 3: Summary of Analysis of Covariance (ANCOVA) on Students' Achievement in Social Studies

Source	Type III Sum of Squares	Df	Means Square	F	Sig.	Partial Eta Squared
Corrected Model	6349.830a	12	529.152	19.057	.000	.641
Intercept	7559.442	1	7559.442	272.248	.000	.680
PREACHV	462.167	1	462.167	16.645	.000	.115
TREATMT	4498.063	1	4498.063	161.995*	.000	.559
Error	3554.142	128	27.767			
Total	148460.000	141				
Corrected Total	9903.972	140				

R Squared = .641 (Adjusted R Squared = .607)

Table 3 reveals that there is a significant main effect of treatment on students' achievement in social studies ($F_{(1,128)}$ = 162.00; P<0.05). Therefore, H_{02} is rejected. To further examine the achievement scores of the students across the groups, Table 4 is presented

Table 4: Estimated Marginal Means on Students Achievement in Social Studies

Variable	N	Mean	Std.Error
Pre-score Achievement	141	19.02	-
Post –score Achievement	141	29.79	.490
Treatment			
Control	53	23.55	.78
Experimental	88	36.03	.59

Table 4 reveals that students exposed to computer-based self-learning instructional strategy have higher achievement mean score (36.03) than their counterparts in control group (23.55); and the difference between them is statistically significant.

H_{03}**:** There is no significant main effect of treatment on junior secondary school students' retention in social studies.

Table 5: Summary of Analysis of Covariance (ANCOVA) on Students' Retention Scores in Social Studies

Source	Type III Sum of Squares	Df	Means Square	F	Sig.	Partial Eta Squared
Corrected Model	5009.836	12	417.486	13.516	.000	.559
Intercept	5953.571	1	5953.571	192.739	.000	.601
PREACHV	475.429	1	475.429	15.391	.000	.107
TREATMT	3454.800	1	3454.800	111.845*	.000	.466
Error	3953.824	128	30.889			
Total	124777.000	141				
Corrected Total	8963.660	140				

R Squared = .559 (Adjusted R Squared = .518)

Table 5 reveals that there is a significant main effect of treatment on students' retention scores in social studies ($F_{(1,128)} = 111.85$; $P<0.05$). Therefore, H_{03} is rejected. To further determine the achievement scores of the students across the groups, Table 6 is presented

Table 6: Estimated Marginal Means on Students' Retention Scores in Social Studies

Variable	N	Mean	Std.Error
Pre-score Achievement	141	19.02	-
Post –score Retention	141	27.16	.52
Treatment			
Control	53	21.69	.83
Experimental	88	32.63	.62

Table 6 reveals that students exposed to computer-based self-learning instructional strategy has higher retention mean score (32.63) than their counterparts in control groups (21.69); and the difference between them is statistically significant. .

Discussion of Findings

The study showed that there is no significant effect of treatment on students' attitude towards social studies. The pre-treatment attitude score was positive and the situation remained positive after the treatment which implies that the treatment did no have negative effect on students' attitude. The consistence students' positive attitude towards social studies as revealed in the study implies that poor academic achievement in the subject could be attributed to ineffective instructional strategy that is prevalent in social studies classroom. The study further revealed that there is significant main effect of treatment on students' achievement and retention in social studies. The experimental group significantly performed better than the control group as reflected by the mean scores obtained in the posttest and delayed-test. This implies that the computer-based self-instructional puzzles are more effective in facilitating learning and enhancing recall. This can be attributed to the efficacy of computer based instruction as revealed by; Michalewicz and Michalewicz (2008), Kimberlee (2010), Mudashiru and Adedeji (2010), and the quality of instructional puzzle in enhancing academic achievement as posited by Ann (2006), Michalewicz and Michalewicz (2008), and Ackert (2009).

Recommendations

Based on the findings, the following recommendations are made:
- The development and use of computer-based self-learning instructional puzzles in social studies at junior secondary school should be encouraged by curriculum planners.
- Social studies teachers should be encouraged to adopt computer-based self-learning instructional puzzles in social studies classroom.
- Necessary facilities that can facilitate effective use of computer-based self-learning instructional puzzles should be provided in all schools.
- Both serving and pre-service social studies teachers should be exposed to the design, development and utilisation of computer-based self-learning instructional puzzles in social studies classroom through workshops and seminars.

References

Abimbade, A. (2006). ICT in Education: Teacher Preparation and Quality Assurance in Africa. *Journal of e-learning 2.1.1 06-135.*

Adeyanju, J.L. 2000. Basic Concepts in Educational Technology: A practical handbook for in- service and pre-service teachers in West Africa Countries. Published for University College of Education, Ghana.

Ackert, L. (2009). Educational Benefits of Puzzles Retrieved 28/6/2010. From *http://www.examiner.com/x-22987-littlefon-Homeschooling-Examiner-y2010m.*

Adams, S. (2004). Using Learning Outcomes, Report for United Kingdom Bologna Seminar 1-2 July, 2004, Heriot-Watt University (Edinburgh Conference Centre) Edinburgh. Scotland.

Ajelabi, A. (2005). Essential of Educational Technology. Lagos Raytel Communication Ltd.

Ann, B. (2006). Teaching with Puzzles Retrieved. 11/12/2010 from *http://educational.more4kids.infor/26/teaching-with-puzzles.*

Ayodeji, I. (2009). Gender and Middle Basic Social Studies Curriculum: A conceptual overview. *Nigeria Journal of Curriculum Studies. 16(4):199-209*

Dale, E. (2011). Learning Retention rate. Retrieved 27/08/2011 from *http://www.tenouk.com/learningretentionrate.html.*

Ediyan, S.D & Ubi, I. E. (2012). Relative Effectiveness of Inquiry and Expository Methods o Teaching Social Studies on Academic Performance of Secondary Students in Akwa Ibom State, Nigeria. *British Journal of Arts and Social Sciences. 8(1):95-102*

Edozie, G. C. (2009). Citizenship Education in Primary Social Studies Curriculum: Some blind spots. *Journal of Childhood and Primary Education. 6(1):48-58*

Edwin, S. 2010. The factors that affect the learning ability of a child. Retrieved. 14/11/2010 from *http://www.saching.com/Article./TheFactors-That-Affect-theLearning-Abilityof-a-child-91html.*

Falkner, N. , Saoriamarthi, R. , & Michalewic, Z. (2009). Puzzle-Based Learning: The First Experience. Retrieved, 23/6/2010 from *doi.ieeecomputersociety.org/10.1109/MC.2010.113.*

Federal Ministry of Education. 2007. *9-Year basic education curriculum social studies for JSS 1-3.* Nigerian Educational Research and Development Council

Howland, J. , Laffety J. , & Espinosa, L. (1997). A Computing Experience to Motivate Children to Complex Performance. *Journal of Computing in Childhood Education 8.391-311*

Iyamu, E.O.S. , & Aduwa-Ogiegbaen S.E.O. (2008). Assessment of the use of Educational Technology by Social Studies Teachers in Secondary Schools in Western Nigeria. http://www.mendeley.com/research/assessment-education-technlogy-socialstudies- Retrieved 05/05/2012.

Jimoh, A.S. , & Akindoju, O.G. (2010). Computer Application in Secondary School: Constraint and Implication for Social Studies Instruction. Journal of Education Media and Technology vol. 14.1

Kazi, N.P. (1998). An Investigation into Teaching for Effective Development in Social Studies Education in selected Secondary Schools in Pankshin Local Government Area of Plateau State, Nigeria. http://dspace.unijos.edu.ng/handle/101485/1689. Retrieved 1/05/2012.

Khaled, A and Chiodo, J. J. 2004. Students' perception of social studies: A case study of

middle school and high school students in Jordan. Retrieved 23/12/2010 from *http://www.nationalforum.com/Electronic.%20Journal%20volume/Alazzi%20Khaled%2students%20perception%20of%20school%20social%20studentpdf.*

Kimberlee, B. (2010). What is Computer-Based Instruction in Education? Retrieved 5/3/2010from*http://www.ehow.con/facts_6081722_Computer_based_instruction_educationhtml.*

Lawal, H.M. , & Abdullahi, S.Y. (2002). Computer as a Tool for National Development. Department of Mathematics, Statistic and Computer Studies. Federal Polytechnic, Bida

Lim, D. H. , & Morris. M. (2009). Learner and Instructional Factors Influencing Learning Outcomes within a Blended Learning Environment. Retrieved 2/09/2011 from *zhttp:findarticles.com/plarticles/mi_7100lis_4_12/ai_n42367600/pg_2/:tag=mantle_skin;content.*

Mezieobi, K.A., Fubara, V.R. , & Mezieobi, S.A. (2008). Social Studies in Nigeria: Teaching Methods, Instructional Materials and Resources. Owerri. Acadapeak Publishers.

Michalewicz, Z., & Michalewicz, M. (2008). Puzzle-Based Learning: An Introduction to Critical Thinking Mathematics and Problem Solving. Melbourne: Hybrid Publishers.

Mudashiru, O.Y. , & Adedeji, O. A. (2010). Effects of Computer Assisted Instruction (AI) on Secondary School Students Instruction Performance in Biology. The Turkish online Journal of Educational Technology Retrieved 9 issue 1. Retrieved on 15/1/2001 from *http://www.tojet.net/articles/918.pdf.*

Nelson, B. (2011). Puzzles for Education. Retrieved 29/01/2011 from *http://searchwarp.com/swa68008.puzzle-for-education.htm.*

Okobia, E.O (2012). The Teacher Factor in Enhancing Quality Assurance in the Teaching/Learning of Social Studies. *Review of European Studies. 4(4);148-156*

Oladele, J.O.(2004). Fundamentals of Educational Psychology (fifth edition). Lagos: Johns-Lad Publishers Ltd.

Olibie and Ezeoba 2012. Effect of guided inquiry method on secondary school students achievement in social studies curriculum in Anambra State. Retrieved 2/5/13 from *http://webcache.googleusercontent.com/research?*

Orungbemi, O. (2008). How Information Technology can Aid the Teaching of Social Science Education. *Nigerian Journal of Social Studies* xi(1) Oct, 2008.

Owuamanam, D.O. & Owuamanam, T.O. (2004). Fundamentals of Educational Psychology. Lagos: Bolabay Publications.

Scott, K. (2002). Ten Ways to Use Puzzle in Mathematics Education. Retrieved. 28/6/2010 from *http://www.scott.Kim.com/education/tenwyas.html*

Sewell, D.F. (1990). New Tools for New Minds. London: Harvester Wheat Sheaf

Yusuf A. 2004: Effect of cooperative institutional strategy on students' performance in social studies. Retrieved 1/05/2012 from http://www.musero.org.ng/publications/effect-of-cooperative-Instructional-strategy.