Efficacy of Augmented Reality as a Pedagogical Strategy in Development of Student Learning of Creative Arts

Odewumi, Michael Olubunmi*

Abstract

Augmented Reality AR is a new trend in technology of instructional delivery. Despite the usefulness and its adoption for learning, its effective application to learning has not been fully established. Therefore, the study investigates empirical foundations of augmented reality (AR) in line with creative arts. Quasi-experimental devise of pre and posttest was utilized. Study lasted for Six weeks of two periods of eighty minutes per week. 65 students from two junior schools divided into both teacher centred and experimental groups. Two null hypotheses were tested with t-test and null hypothesis were rejected. Study make it known that students posttest mean are different, likewise the post test of the two schools. The findings concluded that Augmented Reality is positive and enhances learning. The conclusion of the study can be generalized to greater extent on the aims of emerging technology that when they are utilized well, they may increase learning of the students.

Keywords: Mobile technology, teaching and learning**, i**nformation communication technology, gender.

Introduction

In recent times, education has shifted from being teacher-centred to learner-centred. The teacher formerly dominated teaching in the classroom rendering the learner to be passive. With the advent of technology, instructional delivery has metamorphosed to become student-centred in all stages of education globally. This creates problem of selection and use in terms of technological tools for instructional delivery by the instructors.

There is no gain saying that one of the technological tools employed for knowledge impartation and development of learners cognitive reasoning is Augmented Reality (AR). Therefore, Augmented Reality is referred to as an emerging technology that dynamically blends real-world environments and digital context-based information for the celerity of learning. In essence, the study intends to investigate the extent to which the utilization of Augmented Reality could have positive changes in the cognitive development of learners when used by the instructor to tutor the learners on creative arts.

*Department of Educational Technology, Faculty of Education, University of Ilorin. Ilorin, Nigeria, Orchid: https://orcid.org/0000-0003-1715-8763, Corresponding Author email: agbegilerebunmi2@ gmail.com.

Literature Review

Currently, the trend in mobile technology has made the Augmented Reality (AR) a system that is of accessible and affordable for public usage, whereby interactive digital contents are accessed and shared through Smartphones, Tablets, Camera, GPS sensors to real-world environments through the cheap cost of these technological devices (Toledo-Morales & Sanchez-Garci, 2018).

Empirical studies on meaning of Augmented Reality (AR) remain controversial; researchers have perceived Augmented Reality (AR) as exceedingly important in the context of instructional delivery. For example, Cuendet, Bonnard, Do-Lenh, and Dillenbourg (2013) explained that AR can be referred to as the technology that has the capability to display digital material and content to real-world objects. In the same vein, Wojciechowski and Cellary (2013) described AR as a prolongation to virtual reality (VR), with some additional advantages. Equally, Jorge, Silvia, Ramon, Sabine, and Kinshuk (2014) clarified AR technology as a technology which produces an environment for generating information by computers within the real world sceneries.

The study of Dunleavy and Dede (2014) mentioned two forms of AR commonly used in education; location-aware and vision-based. The Location-aware AR depends mostly on GPS-enabled for mobile technological devices, while vision-based AR necessitates the learner to handle their smartphones toward a targeted object. Likewise, Sayed, Neven, Zayed, and Sharawy (2011) described AR as a technology which assists in adding virtual objects on the digital devices to real scenes by giving the addition of the missing facts in real life. More so, augmented reality (AR) is a technological means that permits video, image or animation to cover a selected and trigger image, with the real-world environment in the real time (Carmigniani, Furht, Anisetti, Ceravolo, Damiani, & Ivkovic, 2011; Chang, Morreale, & Medicherla, 2010). In essence AR promotes learning through e-technology.

Many researchers have been done on Augmented reality (AR) in the context of education among them is the study of Fernandez (2017) worked on the developed role of the virtual and augmented reality in technologies of education. The author stressed the challenges in adapting these technologies especially to improve learning outcomes of learners. The author mentioned six-step methodology in adopting these technologies. The essay concludes with the opportunities facing augmented and virtual reality within the context of online education. Likewise, Mat-jizata, Jaafarb, and Yahayac (2017) studied augmented reality AR as a means of teaching and learning tool in the primary schools. The study further examined the differences in the performances and students motivation to study. In essence, the study concluded with the revelation of significant differences in the performance and motivation of students to learn.

Also, Zaki, Zain and Zanilabdin (2018) researched on the augmented reality in fostering STEM teaching and learning. The study further supports STEM education and developed an augmented reality (AR) application that resulted in encouraging students to study Sciences. The application is of beneficial to students in sciences and astronomy. On the other part it assists instructors in delivering learning content more interestly. Similarly, Rezende, Albuquerque, and Ambrosio (2017), presented a paper on e-mobile educational tool for kids, with the Jigsaw methodology based on augmented reality (AR), purposely to improve teaching and learning experience. The paper revealed that the tools are interactive and creative fun in the environment for learning, thereby motivating students to learn.

The relevance of Augmented Reality (AR) in education has also been itemized. Studies have stressed the relevance and usefulness of Augmented Reality (AR) through these aforementioned researchers, for example Laine, Nygren, Dirin, and Suk (2016) and Joo-Nagata, Abad, Giner, and Garcia-Penalvo (2017) mentioned that AR technology has the capability to provide efficiency in the understanding of some abstract ideas, that can lead to develop cognitive and spatial abilities. Also, Wasko (2013), and Cheng and Tsai (2016) declared that AR, is relevant to educational environment in the field of tourism. Likewise, Squire and Jan, (2007) affirmed that AR provides information and environmental stimuli that exposed the users to the visual and rich informative environment

Augmented Reality (AR) has been used and confirmed as very effective in teaching and learning of different subjects on the school curriculum. For example, Huang, Li, and Fong (2015) mentioned the usefulness and effectiveness of Augmented Reality (AR) on foreign and English languages and biology. Similarly, Huang, Chen and Chou (2016) submitted that Augmented Reality (AR) is useful and effective in studies of environmental education. Likewise, Chang, Hsu, and Wu (2018) declared the effectiveness of Augmented Reality (AR) in improving the students' rate of understanding on Chemistry. More so, Dalim and Kolivand (2017) stated that augmented reality (AR) technology has been utilised and found as enhancing effective teaching and learning in many fields of study such as military, marketing and entertainment. The aforementioned study revealed the supremacy and effectiveness of Augmented Reality (AR) on different subject. Nevertheless, the study intends to find out if the application of Augmented Reality (AR) will improve the cognitive ability of students when employed to teach creative arts.

The theoretical framework of this study is based on social constructivism, that emphasizes learning surroundings and experiences of the learners. The Augmented Reality (AR) is said to be emerging technological tools that transform education from passive to active, it also presents potential and relevant contributions of learning content to students. Similarly, the existing mode result promoting the perception and use of ICT to improve the pedagogical process of learning and teaching in favour of both

learners and the instructor (Badia, Chumpitaz, Vargas, & Suarez, 2016; Holley, & Howlett 2016).

However, the study of John Dewey and Lev Vygotsky presupposed that learning and experiences of learners are inseparable (Liu & Chen, 2010). Moreover, having this in mind, the study of Schcolnik, Kol, and Abarbanel (2006) mentioned that the constructivists' theory rests on technology integration coupled with the nature. However, as learners utilize technology-centered classroom and learning through interactivity and experiences, learning and experiences become wider with constructivists and interactivities, while knowledge is acquired via experiential and collaboration (Lin & Jou, 2013). On this note, individual teachers' perception of constructivism and implementation new technology tools in classrooms are guided by their experiences

Statement of the Problem.

The impact of students and their performance in utilizing innovation in terms of emerging technologies has been investigated. Although, several studies have explored the learning Apps in the 21st-century education has been put forward as the critical factors leading to users' adoption and utilization of technology for learning and teaching. Also, Allen and Seaman (2014) established that invention and use of technologies of learning in term of educational apps for m-learning and e-learning in institutions are product of online content delivery.

On this note, therefore, the study is putting forward to fill the existing gap that has been created by previous research work on the effectiveness of Augmented Reality (AR) for teaching and learning. Since all known works on augmented reality (AR) have not been done Creative Arts in the junior secondary school system specifically on the teaching of culture in Nigeria educational context which is the main focus of the study. Therefore, this study looked at the values of augmented reality (AR) on the students' achievement on the field of creative arts in the junior secondary education in Nigeria.

Research Questions

1. Is there any difference in the achievement of students exposed to augmented reality and those taught with teacher centred method?
2. What is the difference in the–achievement of both male and female students exposed to augmented reality?

Research Hypotheses

1. $H0_1$: There is no significant difference in the achievement of pupils exposed to Augmented Reality and those taught with teacher centred method.
2. $H0_2$**:** There is no significant difference in the–achievement of both male and female pupils exposed to Augmented Reality.

Methodology

The Quasi-experimental design made up of pre-test and post-test was used to execute the study. The population comprised all JSS students in Ogbomoso South Local Government, Oyo State, Nigeria.

Sample and Sampling Techniques

The sampled were divided with simple ticketing into both teachers centred and experimental group. The simple random sampling technique was used for selection of sample for the study. The sample therefore consisted of 65 students of which 32 were boys and 33 were girls, with the age ranges of 11 to 14 years of junior secondary class 2 (Basic 8). The samples from each selected school were divided into both teacher centred and experimental groups. The selection of the two schools; private and public school, were based on these criteria: Both schools have been in existence for the past 10 years in the locality. The school has trained teachers handling the learners in the school on creative arts for more than five years. And also, the students' evidence of accessibility and use of tablet via internet and the school with computer centres having functioning wifi facilities. The researchers used six weeks to familiar and sensitize the students with the ethics and conduct of the study was done on the first week. The sixth week features evaluation and students exposure to Argument Reality Test (ART) on paper based test as summative for the study while the four weeks were for intensive teaching via wifi.

Research Instrument

The instrument Argument Reality (AR) consisted of content to be learnt within the specified four weeks of instruction, covering the Nok culture, Ife culture, Benin culture and Ugbo Ukwu culture. The students were asked to assess the content online through wifi in the specified location and directed for each week.

Table

S/n	Wks	Periods	Topics	URL Direction
1	1	2	Nok	https://www.google.com/search?q=nok+culture&oq=nok+culture+&aqs=chrome..69i57.2812j0j7&sourceid=chrome&ie=utf-8
2	2	2	Ife	https://www.google.com/search?q=ife+culture&oq=ife+culture&aqs=chrome.0.0l6.7377j0j7&sourceid=chrome&ie=utf-8
3	3	2	Benin	https://www.google.com/search?q=benin+culture&oq=benin+culture&aqs=chrome.0.0l6.984j0j7&sourceid=chrome&ie=utf-8
4	4	2	Ugbo ukwu	https://www.google.com/search?q=ugbo+ukwu+cuture&oq=ugbo+ukwu+cuture&aqs=chrome..69i57.398j0j7&sourceid=chrome&ie=utf-8

The adapted test instrument named Argument Reality Achievement Test (ARAT), was selected from the validated National Examinations Council (NECO) for Junior Secondary School past question based on selected topics. The instrument is alienated into two distinct sections A&B. Furthermore, Section "A" asks for the students Bio-data, Name of school, Class and Gender. While, Section "B" paying attention to the multiple-choice objective question. The multiple-choice objective questions item has five options "A-E" of likely answer to the question asked. The ARAT was administered on paper with pencil. The experiment process is written in the guide and manual booklets given to both the learners and the instructors for easy monitoring of both the learners and the study.

The experimental groups of both schools were requested to sit on convenient seats in a mini hall to be used for the study in two different locations. On the content, the first week of the study was assigned to teach the students with the instruction on the study and to expose the students to the uses of tablets. A tablet each was given to the student and they were all instructed to access the content through the wifi as learnt from the instructor at the beginning of the study. The student read the content on the individual tablet given to them.

Figures 1. The student with tablets to assess the content

After each lesson the tablets were retrieved from the students and the instructor evaluated the content with the students. In the same vein, the teacher centred methodologies along with the appropriate instructional resources were utilized to teach the teachers-centered group by the instructors.

The Argument Reality Achievement (ARAT) were made up of three sections; A, B and C. The first Section "A" was for learners to supply their personal name, school and gender while section "B" was for test duration (time allotted) and section "C" for XXX multiple-choice objective questions with answers having five options "A - E" of probable answers to the question. Argument Reality Achievement (ARAT) was of paper and pencil based test given to the students to test their understanding of the content. The students were seated in a classroom wish their assigned numbers attached to the seat. The correct scoring of the test carries '2' marks while wrong answer carries '0' the total all over 50 obtainable marks. The last week of the study witnessed the evaluation, administration and supervision of the test and marking of the given test, scorings and handing over students' scores to the researchers for onward data analysis.

Hypothesis Testing

Testing of Hypothesis 1: There is no significant difference in achievement of pupils exposed to Augmented Reality and those taught with teacher centred method. To test the above hypothesis, the pre-test of the student were using as covariates, this reflect in Table 1.

Table 1

The t-test table of the post-test mean of female and male students' scores taught with augmented reality

Variables	N	df	Mean	Std. Deviation	t	Sig. (2-tailed)
Female	32	63	20.6563	2.54773	-35.186	000
Male	33		45.3030	3.06681		

Table 2 indicated that t(65) = -35.186, p =.000(P <0.05) this means the stated null hypothesis is rejected.

Testing of Hypothesis 2: There is no significant difference in the-achievement of both male and female pupils exposed to Augmented Reality. In testing the hypothesis 2 above, the female and male students scores taught with Augmented Reality were tested with t-test statics to compare the mean reflected in Table 2.

Table 2
The t-test of post mean of public and private school with augmented reality

Variables	N	df	Std. Deviation	Mean	t	Sig. (2-tailed)
Public school	30	63	12.8	32.7	15.130	.000
Private school	35		12.9	33.7		

Table 2 indicated that t(65) = -15.130, and p =.000 (P <0.05) this means the stated null hypothesis is rejected.

Discussion

The null hypotheses were rejected. Thus there was a difference between the mean of both male and female students. Likewise there is a difference in the post test mean of the two schools.

Based on the above, the finding was the same with the findings of Martín-Gutierrez, Fabiani, Benesova, Meneses, and Mora (2015) whose findings stressed that AR technology permeates and promotes learning in all stages of education globally. The findings also agreed with the findings of Di Serio, Ibanez, and Kloos (2013) that AR improves and promotes positive teaching in terms of motivation and involvement of learners. Likewise the study corroborated the findings of Giasiranis and Sofos (2017) that AR contributes to the improvement and performance of positive learning processes. The findings concur with the findings of Han, Hyun, and So (2015) that AR is positive and allows the students to use technology wisely in the classrooms to integrate and improve teaching and learning.

Moreover, the findings agreed the findings of Wei, Weng, Liu, and Wang (2015) and Zhang, Sung, Hou, and Chang (2014) who revealed that AR as a technology devices increases academic performance of learners. Similarly, the findings are in accordance with Dalim, Kolivand, Abuhashish, Sunar, and Billinghurst (2017) who study pointed out that Augmented Reality as a enriches teaching and learning in educational institution. The study of Hsiao Chang, Lin, and Wang (2016) and Huang, Chen and Chou (2016) who expressed that AR enhances and promotes learning satisfaction. Furthermore, the study findings agreed with the study of Tobar-Tobar-Muñoz, Baldiris, and Fabregat (2017) who stated that an AR technology promotes long-term memory and problem-solving of the learners. Also, this corroborates the finding was in match the findings of Diaz, Hincapie, and Moreno (2015) and Akcayir, Akcayir, Pektas, and Ocak (2016) whose study reflected the process through the uses of Augmented Reality AR.

Conclusion

The study confirmed the usefulness of Augmented Reality (AR) as a technological tool that enhances learning. Similarly, it promotes e-teaching and learning

in the classroom via wifi. Also, it supports individual learning by encouraging boldness in students.

Recommendations

The following recommendations are made based on the study: (a) students should be encouraged to be literate on the use on the of computer, (b) students should be taught how to work with internet with tablets and cell phone, (c) there should be adequate equipped computers laboratory in each school to facilitate the teaching – leaning process and (d) teachers should be exposed to periodic seminars, and in-service and training on emerging technologies that promote adequate learning.

References

Akcayir, M., Akcayir, G., Pektas, H. M., & Ocak, M. A. (2016). Augmented reality in science laboratories: The effects of augmented reality on university students' laboratory skills and attitudes toward science laboratories. *Computers in Human Behavior, 57,* 334–342.

Allen, E., & Seaman, J. (2014). *Grade change: Tracking online education in the United States*. Retrieved from http://www.onlinelearningsurvey.com/reports/ grade change. pdf.

Badia, A., Chumpitaz. L., Vargas, J., & SuArez, G. (2016). La percepcion de la utilidad de la tecnología conforma su uso para ensenar y aprender. *Revista Electronica de Investigacion Educativa, 18*(3), 95-105.

Carmigniani, J., Furht, B., Anisetti, M., Ceravolo, P., Damiani, E., & Ivkovic, M. (2011). Augmented reality technologies, systems and applications. *Multimedia Tools and Applications, 51*(1), 341-377.

Chang, H., Hsu, Y., & Wu, H (2018). Students' development of socio-scientific reasoning in a mobile augmented reality learning environment. *International Journal of Science Education, 40*(12), 1410-1431.

Cheng, K. H., & Tsai, C. C. (2016). The interaction of child–parent shared reading with an augmented reality (AR) picture book and parents' conceptions of AR learning. *British Journal of Educational Technology*, *47*(1), 203–222.

Cuendet, S., Bonnard, Q., Do-Lenh, S., & Dillenbourg, P. (2013). Designing augmented reality for the classroom. *Computers & Education*, *68*, 557–569.

Dalim, C. S. C., & Kolivand, H (2017). Factors influencing the acceptance of augmented reality in education: A review of the literature. *Journal of Computer Science, 13*(11), 581-589.

Di Serio, A., Ibanez, M. B., & Kloos, C. D. (2013). Impact of an augmented reality system on students' motivation for a visual art course. *Computers & Education, 68,* 585–596.

Diaz, C., Hincapie, M., & Moreno, G. (2015). How the type of content in educative augmented reality application affects the learning experience. *Procedia Computer Science, 75,* 205-212.

Dunleavy, M., & Dede, C. (2014). Augmented Reality Teaching and Learning. In J. M. Spector, M. D. Merrill, J. Elen & M. J. Bishop (Eds.), *Handbook of Research on Educational Communications and Technology* (pp. 735-745). New York: Springer Publications.

Fernandez, M. (2017). Augmented virtual reality: how to improve education systems. *Higher Learning Research Communications, 7*(1), 1-15.

Giasiranis, S., & Sofos, L. (2017). Flow experience and educational effectiveness of teaching informatics using AR. *Educational Technology & Society, 20*(4), 78–88.

Han, J., Jo, M., Hyun, E., & So, H.J. (2015). Examining young children's perception toward augmented reality-infused dramatic play. *Educational Technology Research and Development, 63*(3), 455-474.

Holley, D., & Howlett, P. (2016). *Engaging our school teachers: an augmented reality (ar) approach to continuous professional development.* Lecture Notes of the Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering, *160,* 118-125.

Hsiao H., Chang, C., Lin, C., & Wang, Y. (2016). Weather observers: a manipulative augmented reality system for weather simulations at home, in the classroom, and at a museum. *Interactive Learning Environments, 24*(1), 205-223.

Huang, T. C., Chen, C. C., & Chou, Y. W. (2016). Animating eco-education: To see, feel, and discover in an augmented reality-based experiential learning environment. *Computers & Education, 96,* 72–82.

Hung, Y. H., Chen, C. H., & Huang, S. W. (2017). Applying augmented reality to enhance learning: a study of different teaching materials. *Journal of Computer Assisted Learning, 33*(3), 252-266.

Jorge, B., Silvia, B., Ramon, T., Sabine, G., & Kinshuk (2014). Augmented reality trends in education: A systematic review of research and applications. *Educational Technology & Society, 17*(4), 133-149.

Joo-Nagata, J., Abad, M., Giner, G., & Garcia-Penalvo, F. (2017). Augmented reality and pedestrian navigation through its implementation in m-learning and e-learning: Evaluation of an educational program in Chile. *Computers & Education, 11*(1), 1-17.

Laine, T., Nygren, E., Dirin, A., & Suk, H. (2016). Science spots AR: a platform for science learning games with augmented reality. *Education Technology & Research Development, 64*(2), 507–531.

Martín-Gutierrez, J., Fabiani, P., Benesova, W., Meneses, M. D., & Mora, C. E. (2015). Augmented reality to promote collaborative and autonomous learning in higher education. *Computers in Human Behavior, 51,* 752–761.

Mat-jizata, J. E., Jaafarb, H., & Yahayac, R. (2017). Measuring the effectiveness of augmented reality as a pedagogical strategy in enhancing student learning and motivation. *International Journal of Academic Research in Business and Social Sciences*, *7*(1), 225-240.

Rezende, W., Albuquerque, E., & Ambrosio, A. (2017). Use of Augmented Reality to Support Education - Creating a Mobile E-learning Tool and using it with an Inquiry-based Approach. *In Proceedings of the 9th International Conference on Computer Supported Education (CSEDU), 1*, 100-107.

Sayed, E. l., Neven A. M., Zayed, H. H., & Sharawy, M. I. (2011). *Augmented reality student card*--an *augmented reality* solution for the education. *Computers* & Education, *56*(4), 1045-1061.

Schcolnik, M., Kol, S., & Abarbanel, J. (2006). Constructivism in theory and practice. *English Teaching Forum, 4*, 12-20.

Squire K. D., & Jan, M. (2007). Mad city mystery: developing scientific argumentation skills with a place-based augmented reality game on handheld computers. *Journal of Science Education and Technology, 16*(1), 5–29.

Tobar-Muñoz, H., Baldiris, S., & Fabregat, R. (2017). Augmented Reality game-based learning: enriching students' experience during reading comprehension activities. *Journal of Educational Computing Research,* 1-36.

Toledo-Morales, P., & Sanchez-Garci, J. M. (2018). Use of augmented reality in social sciences as educational resource. *Turkish Online Journal of Distance Education-TOJDE, 19*(3), 38-52.

Wasko, C. (2013). What teachers need to know about augmented reality enhanced *Learning Environments. Tech Trends, 57*(4), 17-21.

Wei, X., Weng, D., Liu, Y., & Wang, Y. (2015). Teaching based on augmented reality for a technical creative design course. *Computers & Education, 81*, 221-234.

Wojciechowski, R., & Cellary, W. (2013). Evaluation of learners' attitude toward learning in ARIES augmented reality environments. *Computers & Education, 68*, 570–585.

Wu, H. K., Lee, S. W. Y., Chang, H. Y., & Liang, J. C. (2013). Current status, opportunities and challenges of augmented reality in education. *Computers & Education, 62*(0), 41-49.

Zaki, N. A. A., Zain N. Z. M., & Zanilabdin, A. (2018). AR-SIS: augmented reality application to encourage stem teaching and learning. *The International Journal of Multimedia and its Applications* (*IJMA*), *10*(8), 1-11.

Zhang, J., Sung, Y. T., Hou, H. T., & Chang, K. E. (2014). The development and evaluation of an augmented reality based armillary sphere for astronomical observation instruction. *Computers & Education, 73*, 178-18.