NIGERIAN ONLINE JOURNAL OF EDUCATIONAL SCIENCES AND TECHNOLOGY (NOJEST)

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NIGERIAN ONLINE JOURNAL
OF
EDUCATIONAL SCIENCES
AND TECHNOLOGY

Lecturers' Awareness and Perceptions on The Usefulness of Augmented Reality For Instructional Delivery in Nigerian Universities

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To cite this article:

Bolaji, H. O., & Shittu, A. T. (2021). Lecturers' awareness and perceptions on the usefulness of augmented reality for instructional delivery in Nigerian universities. *Nigerian Online Journal of Educational Sciences and Technology (NOJEST), 3*(1), Pages 80-86

Nigerian Online Journal of Educational Sciences and Technology (NOJEST)

Volume 3, Number 1, 2021

Lecturers' Awareness and Perceptions on The Usefulness of Augmented Reality For Instructional Delivery in Nigerian Universities

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Article Info

Article History

Received:
26th January 2021

Accepted:
6th March 2021

Keywords

Augmented Reality,
Virtual Reality,
Evaluation,
Awareness, Perception

Abstract

The introduction of technology into instructional delivery processes in the institutions of higher learning has taken numerous dimensions in this 21st century. Several concepts have also emanated through the design of interactive instructional contents. Augmented Reality is one of such designs that tend to simplify instructional content for the teaching and learning processes. This study examined lecturers' awareness and perceptions on instructional usefulness of augmented reality. The study adopted a descriptive research design using the survey approach. Simple random sampling technique was employed . The instrument used is a researcher-designed questionnaire with four sections to collect responses on demography, awareness level and perceptions of instructional usefulness of augmented reality. The instrument was validated by four experts comprising two each of educational technology and computer science lecturers. The reliability of the instrument was determined through Cronbach Alpha which yielded 0.91. The questionnaire was administered through Google Form and 197 respondents were able to access it. Three research questions were answered and two hypotheses were tested. Mean and t-test were used to answer the research questions and hypotheses respectively. The findings revealed that the majority of lecturers in tertiary institutions in Nigeria possess high level and rate of awareness and perception respectively. Also, most lecturers found augmented reality to be instructional useful. It is then recommended that a positive move should be built on improving the awareness and perception by way of making infrastructure and equipment available in tertiary institutions in Nigeria.

Introduction

Augmented reality technology has its roots in the field of computer science interface research (Sutherland & Mead, 1977). Bimber and Raskar (2005) explain that augmented reality is systems built upon three major buildings blocks namely tracking and registration, display technology and real-time rendering. AR is categorized as environment of virtual and real events blended to project an interesting scenario which can generate some sort of motivation for learners (Milgram & Kishino, 1994). According to Azuma (1997), AR enhances a user's perception and interaction with the real world.AR is used to augment or substitute users' missing senses by sensory substitution, such as augmenting the sight of blind users or users with poor vision by the use of audio cues or augmenting hearing for deaf users by the use of visual cues (Carmigniani & Furht, 2011).AR is a visualization technique that superimposes computer-generated data, such as text, video, graphics, GPS data and other multimedia formats, on top of the real-world view, as captured from the camera of a computer, a mobile phone or other devices.

Augmented Reality (AR) could also be viewed as a one-time direct or indirect live event of the physical real-world environment enhanced through virtual computer-generated instructions to mould an interesting scenarion. AR can augment one's view and transform it with the help of a computer or a mobile device, and thus enhance the user's perception of reality and the surrounding environment (Osterlund & Lawrence, 2012). AR provides information systems which can personalize the delivery of the multimedia content according to the user's characteristics and the use context, thus supporting their deployment for several scenarios (Kounavis, Kasimati &Zamani, 2012). Augmented Reality aims at simplifying the user's life by bringing virtual information not only to immediate surroundings but also to any indirect view of the real-world environment, such as live video stream (Carmigniani & Furht, 2011). Augmented reality (AR) is a live direct or an indirect view of a physical, real-world environment whose elements are augmented by computer-generated sensory input, such as sound, graphics or GPS data (Grier, Thiruvengada, Ellis, Havig, Hale &Hollands, 2012).

AR can be categorized based on the primary function or the platform framework it serves as opined by Kounavis, Kasimati and Zamani (2012). In the categorization by Kounavis et.al (2012), augmented reality based on primary function includes Droid, DWARF, Layar, IN2, FLAR Manager, Panic and SudaRa. The categories are explained as follows according to Kounavis et.al (2012): *It was explained that Droid augmented reality* is a framework to develop an augmented reality application that operates on Android OS only with location-based and marker-based AR functionalities. The Distributed Wearable AR Framework (*DWARF*) allows the rapid prototyping of distributed AR applications for mobile computers like laptops and palmtop. *Layar* is a framework that works across mobile platforms. Layar is available for Android OS, iPhone OS, Symbian OS and BlackBerry 7 OS devices, comes globally pre-installed on millions of phones and is promoted by leading handset manufacturers and carriers like Samsung, Verizon and Sprint (Madden, 2011).

IN2AR is a framework relies majorly on Flash Player for its operations in detecting images and markers; therefore, it operates on devices that support Flash Player. It recognizes natural features whereby every object or image can be used for detection, as long as it has enough information on it. Another categorization of augmented reality by Kounavis et.al (20120 is *FLAR Manager which supports* compatibility of 3D frameworks, libraries and provides an event-based system for adding, updating and removing markers (Socolofsky, 2009). The *Panic AR* allows integration of extant iOS applications for adding location-based AR features (doPanic, 2012) and finally, the *SudaRA* is a C++ framework that operates in a computer and it supports 3D models, sound, multiple-marker tracking and a well-structured interface among other features (Henrique, 2010). The *FLAR ToolKit i*s an AS3 port of the Open Source library ARToolKit. It allows marker detection from images and computes the camera position in 3D space. Also, it allows the user to choose among various 3D engines (Saqoosha, 2008). AR technology augments the sense of reality by superimposing virtual objects and cues upon the real world in real-time (Carmigniani & Furht, 2011). It was further stated that the main devices for augmented reality are displays, input devices, tracking, and computers. The three major types of displays used in Augmented Reality are head-mounted, handheld and spatial displays. The head-mounted display (HMD) is a display device worn on the head or as part of a helmet which places both images of the real and virtual environment over the user's view of the world.

Handheld displays employ small computing devices with a display that the user can hold in their hands and Spatial Augmented Reality (SAR) makes use of video-projectors, optical elements, holograms, radio frequency tags, and other tracking technologies to display graphical information directly onto physical objects without requiring the user to wear or carry the display (Bimber, Raskar &Inami, 2007). In another taxonomic classification of augmented reality, Peddie (2017) specifically categorizes it into two namely wearable and non-wearable. For a clear understanding of the taxonomy, Figure 1 presents the illustration in a holistic way.

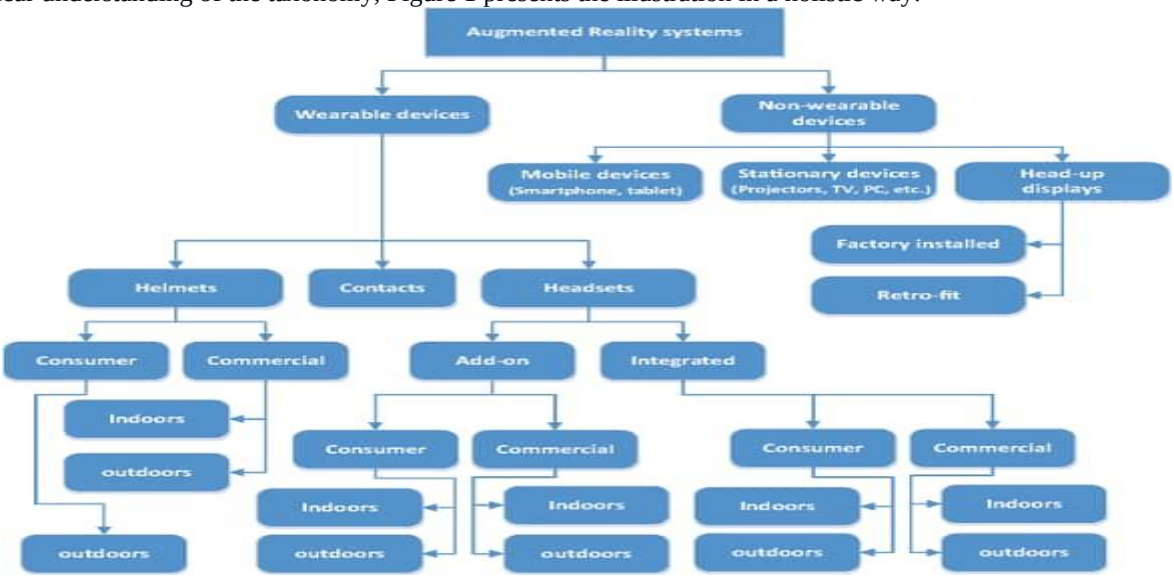

Figure 1: Taxonomy of Augmented Reality
Source: Peddie (2017)

The Taxonomy of Augmented Reality by Peddie (2017) actually simplifies the categorization into wearable and non-wearable devices which gives clarity of direction on the use of AR for various purposes. Examples of the non-wearable devices include mobile devices (smartphones, tablets, etc.), stationary devices (projector, television, personal computer, etc.) and head-up displays (factory installed, retro-fit, etc.). The wearable devices of augmented reality are helmets, contacts and headsets which can be used in indoor or outdoor for consumer and

commercial purposes. Further categorization of augmented reality was given by Edwards-Stewart, Hoyt and Reger (2016) and it is presented in Figure 2

Category	Type	Examples	Characteristics
Triggered	1a. Marker-based: Paper	String (string.co) Blippar (blippar.com)	Paper marker activates stimuli.
	1b. Marker-based: Object	Aurasma (aurasma.com)	Most objects can be made into markers.
	2. Location-based	Yelp (yelp.com) PAJ (t2health.dcoe.mil/positiveactivityjackpot) Instagram (instagram.com)	Overlay of digital information on a map or live camera view. GPS may activate stimuli.
	3. Dynamic Augmentation	Video Painter (itunes.apple.com/us/app/video-painter/id581539953?mt=8) Swivel (Motion; facecake.com)	Meaningful, interactive augmentation with possible object recognition and/or motion tracking.
	4. Complex Augmentation	Google Glass (google.com/glass)	Augment dynamic view and pull internet information based on location, markers, or object recognition.
View-Based	5. Indirect Augmentation	Wall Painter (itunes.apple.com/us/app/wall-painter/id396799182?my=8)	Image of the real world augmented intelligently.
	6. Non-specific Digital Augmentation	Swat the Fly (inengy.com/swatthefly) Bubbles (virtualpopgames.com)	Augmentation of any camera view regardless of location.

Figure 2: Summary of Augmented Reality Categories and Types
Source: Edwards-Stewart, Hoyt and Reger (2016)

The Figure 2 displayed the categories and types of augmented reality with a referenced example and characteristics. The categories are classified into two which are triggered-based and view-based with four types of AR under triggered-based and two under view-based. A clear example and characteristics were given as displayed in Figure 2.

The continuous development of the AR needs some level attention among instructors of tertiary institutions for its effective integration for instructional delivery purpose. Hence, the need to gather empirical information on awareness level, perception rate and instructional usefulness of augmented reality among lecturers.

Research Questions

The following questions guided the conduct of this study;

1. What is the awareness level of augmented reality among lecturers in Nigerian tertiary institutions ?
2. What is the perception rate of augmented reality among lecturers in Nigerian tertiary institutions?
3. Does lecturer in Nigerian tertiary institutions perceived augmented reality to be instructionally useful?

Hypotheses

H_{O1}: There is no significant difference between awareness level and perceptions of lecturers on the usefulness of augmented reality in Nigerian tertiary institutions.

H_{O2}: There is no significant difference between lecturers perception rate and perceived instructional usefulness of augmented reality in Nigerian tertiary institutions.

Methodology

This study was conducted through survey method of descriptive research.. The target population was lecturers in tertiary institutions in Nigeria, simple random sampling technique was adopted and only 197 The questionnaire has four sections (A, B, C & D) which examined respondent's demography, awareness rate, perception level and perceived instructional usefulness of Augmented Reality respectively. The questionnaire was validated by five experts comprising three Educational Technology and two Computer Science lecturers. The observations and suggestions raised by the experts were effected to produce the final draft and was subjected to reliability test of Cronbach Alpha Correlation Coefficient. The reliability test yielded 0.91. Afterwards, the questionnaire was transformed into Google document form and was administered on selected respondents through the Google Form link posted through WhatsApp platforms across tertiary institutions in Nigeria. The responses were subjected to

both inferential and descriptive statistics. Research questions 1, 2 3 were answered through frequency count while the twohypotheses were tested using independent sample t-test.

Results

Research Question One: What is the awareness level of lecturers in Nigerian tertiary institutions about augmented reality?

Table 1:
Frequency Count and Percentage Representation on Awareness Level of Augmented Reality

SN	ITEM	Extremely Aware	Moderately Aware	Slightly Aware	Not Aware
1	Augmented Reality has its root from computer science	58	67	41	31
2	Augmented Reality is about coexistence of real and virtual experience	72	58	56	11
3	Live streaming of video is one of the features of augmented reality	50	91	45	11
4	Augmented Reality is a live direct and indirect view of the environment	53	91	47	06
5	Smartphones can serve as medium for augmented reality experience	105	60	22	10
6	Augmented Reality superimposes computer-generated visualization on the real world experience	87	54	38	18

The responses from respondents based on awareness level with respect to augmented reality showed that most lecturers in tertiary institutions in Kwara State are extremely aware. This is evident in the items that measured the awareness level of the respondent in regard to augmented reality. For instance, item 1 of Table 1 reveals that majority (125) of the respondents are aware that the concept augmented reality has its root in Computer Science and in addition, 141 of the lecturers examined responded to item 3 with overwhelming positivity which implies that they are extremely aware that augmented reality have as part of its features live streaming of videos. Furthermore, the majority (141) of the respondents affirmed the fact that augmented reality superimposes computer-generated visualization on the real world experience. Conclusively therefore, the awareness level of lecturers in tertiary institutions in Nigeria is extremely high.

Research Question Two: What is the perception rate of lecturers on augmented reality in Nigerian tertiary institutions?

Table 2:
Frequency Count and Percentage Representation on Perception Rate of Augmented Reality

SN	ITEM	Highly Perceived	Moderately Perceived	Slightly Perceived	Not Perceived
1	Augmented Reality is a visualization tool that can capture attention of individual	81	79	26	11
2	Augmented Reality do create an interesting experience while visualizing it	92	78	16	11
3	Augmented Reality possess a distractive tendencies from real issues	19	83	66	29
4	Augmented Reality is a fluke that creates disillusion in prospective viewers	17	74	41	65
5	Augmented Reality does not represent a real situational experience of the real world	72	89	31	05
6	Augmented Reality do motivates viewer to develop interest	109	88	00	00

Table 2 is titled perception rate of lecturers on augmented reality and it displays the frequency count on the trend of responses collated from the examined samples. The result also revealed in this instance that the perception rate is also high. For instance, in item 4 of Table 2, 106 of respondents have a high perception rate on the fact that augmented reality is not a fluke and that it actually presents a real life experience with regard to computer

simulations to promote real life activities. Importantly also, 170 respondents' perceived augmented reality to be a creative means of projecting interesting visualization and the 197 lecturers examined also have a high perception rate with respect to the motivational tendency of the augmented reality. In conclusion, the perception rate about augmented reality is very high among lecturers in Nigerian tertiary institutions.

Research Question Three: Does lecturer in Nigerian tertiary institutions perceived augmented reality to be instructionally useful?

Table 3:

Frequency Count Representation on Instructional Usefulness of Augmented Reality

SN	ITEM	Strongly Agree	Agree	Disagree	Strongly Disagree
1	Augmented Reality is useful for classroom instructional delivery	103	81	07	06
2	Augmented Reality provides a medium to bring a real life situation into the classroom environment	94	103	00	00
3	Explosive practical can be demonstrated through augmented reality in the classroom	81	58	26	22
4	Augmented Reality creates distraction from gaining attention of students	39	83	20	55
5	Augmented Reality concretize learning through the visualization of computer-generated images to explain difficult concepts	54	127	06	00
6	Learning theories promotes the use of augmented reality for instructional delivery	75	117	05	00
7	Augmented Reality builds on the psychomotive domain of learning through visualizing the real world in virtual means	109	83	05	00
8	Difficulty concepts can be simplified with the use of augmented reality for instructional delivery	94	103	00	00

The high level and rate of lecturers' awareness and perception respectively is expected to propel its application or integration into instructional delivery activities in tertiary institution. Table 3 reveals the opinion of lecturers on the instructional usefulness of augmented reality. From the frequency of results displayed in Table 3, it was deduced that most lecturers examined are of the view that augmented reality is instructionally useful (184) for classroom teaching. Furthermore, the use of augmented reality for instructional delivery actually builds on the development of the psychomotive domain of learning (192) whereby students would be able acquire necessary skill that would make them to be employable, resourceful and result-oriented. It was as well revealed from the responses of the lecturers that augmented reality possesses the ability to concretize learning (181) in students and as well promote an interesting learning environment to simulate explosive practical (139) experience that cannot be carried out in the laboratory.

Hypotheses Testing

H_{O1}: There is no significant difference between awareness and perception of lecturers on augmented reality in Nigerian tertiary institutions.

Table 4:

t-Test Output of Significant Difference between Awareness Level and Perception Rate

Variable	Number of	Mean	SDtandard		t	df	P-Value
Awareness	197	11.99	4.37				
Perception	197	12.16	3.34	0.17	12.53	196	.000

Table 4 reveals the result of the t-test analysis and it showed that there is a significant difference between awareness level and perception rate of lecturers in tertiary institutions on augmented reality. By implication, [$t(196) = 12.53$; sig = .000 and $p < .005$], the hypothesis is rejected because there is a significant difference between responses from sampled population based on awareness level and perception rate. By extension, the mean difference is 0.17 at a confidence level of 95%. The mean score for awareness level (11.99) differs significantly from the mean score of the perception rate (12.16). Hence, the awareness level actually has significant influence on the perception rate of lecturers in tertiary institutions in Nigeria with respect to augmented reality.

H_{O2}: There is no significant difference between perception and perceived instructional of augmented reality among lecturers in Nigerian tertiary institutions.

Table 5:
t-Test Output of Significant Difference between Instructional Usefulness and Perception Rate

Variable	Number of Respondents	Mean	Standard Deviation	Mean Difference	T	Df	P-Value
Instructional Usefulness	197	14.72	2.25				
				2.56	40.98	196	.000
Perception	197	12.16	3.34				

Table 5 reveals the result of a t-test analysis and it showed that there is a significant difference between instructional usefulness and perception rate of lecturers in tertiary institutions on augmented reality. By implication, [$t(196) = 40.98$; sig = .000 and $p < .005$], the hypothesis is rejected because there is a significant difference between responses from sampled population based on instructional usefulness and perception rate. By extension, the mean difference is 2.56 at a confidence level of 95%. The mean score for instructional usefulness (14.72) differs significantly from the mean score of the perception rate (12.16). Hence, the instructional usefulness was significantly influenced by the perception rate of lecturers in tertiary institutions in Nigeria with respect to augmented reality.

Conclusion

The concept of augmented reality is a computer-generated visualization that tends to support the delivery of instruction in a simplified manner thereby assisting lecturers to further breakdown complex topics to an understandable subject. The awareness level and perception rate of lecturers in tertiary institutions in Nigeria greatly influence the understanding of its instructional usefulness. Conclusively therefore, most lecturers in tertiary institutions in Nigeria are well in tune with the ability of the augmented reality as an instructional tool and are deeply rooted in its potential in simplifying the teaching and learning process.

Recommendations

Based on the results presented and the conclusion drawn thereafter, the following are the recommendations of this study:

1. A routine conference, workshop and seminar should be organized by professional associations, especially learning technology-based forum, to sustain and step-up awareness among all lecturers in Nigeria.
2. Also, a conducive atmosphere should be created by governmental agencies to promote the application of augmented reality into instructional delivery such that perception rate would continue to soar to increase positive perception.
3. Tertiary institution administrators, in conjunction with the government at various levels should provide infrastructures and equipment that would further encourage lecturers to integrate augmented reality for instructional delivery.
4. The sustenance of awareness through sponsored campaign and conference attendance, both national and international, should be the concern of education fund-granting bodies in Nigeria.
5. Conclusively, lecturers should be provided with electronic gadgets and fund that would concretize the perception about augmented reality and further encourage them to be an enabler for other in the instructional delivery industry.

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