Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.7, No.17, 2016

Using Design & Animation Concepts to Produce Animated Instructional Resources that Can Facilitate Open Distance Learning in Science and Technology Education

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ABSTRACT
This paper presents an outline on how teachers can use "The Design Process and Animation Techniques to produce animated instructional resources (AIR) which, can be used to facilitate Open Distance Learning in especially Science and Technology Education. A model of the Animated Instructional Resource was developed for the teaching of Human Digestive System, piloted in selected senior secondary schools in Bauchi State Nigeria. The results indicated that, the developed AIR had significant impact in students' learning of the subject matter. AIR was found to be a veritable learning tool for use in and out of classroom, even from remote locations. It was also found to be a good means of stirring teachers' creativity towards developing similar resources, and that this initiative could help boost open distance learning where specialist teachers and high-tech resources are scarce for regular in-class teaching/learning activities.

INTRODUCTION

Education plays a dominant role in the enhancement of the economy, and total development of a nation. As new technologies continue to emerge, knowledge of how best countries can tap from these developments and improve their educational systems matters. Instructional aids play very significant roles as medium of communication for learning. Besides, it makes learning more effective and real for the learners, and at the same time helps in clarifying concepts for better understanding (Yalams, Martin & Lewis, 2012). According to a publication (UNESCO n.d.), Visuals are used effectively to strengthen communication, and they help people remember what they hear. For a majority of people it is easier to remember pictures than to remember just words, as such people like to put into pictures what they are hearing. This same publication further identified the following as key roles visuals play in communication when used in the class or anywhere else. 1 .Visuals create relevance and can give accurate representation of ideas, help to define facts and information easily and precisely. 2.Visuals save time and makes better illustration. .They help people to remember and recall much better. 4. Visuals can stimulate human imagination. For instance, pictures can often be used as a starting point for discussions and debates. Visuals are not only a quick way of acquiring facts but also of using them. 5. Visuals provide a shared experience, in that, when the communicator and the audience share a common experience, communication becomes much easier.

Nigeria being one of the most populous countries in Africa, with 36 states and a population nearly the total of the population of West Africa put together (African Encyclopedia 1974}, a country blessed with vast amount of human and material resources yet, is still ranked low in educational development and technological advancement. Given the geographical spread of Nigeria, reaching out to especially remote locations with modem technological and educational resources can be very challenging, particularly in some parts of the Northern States. It is even more challenging in the fields of Science and Technology (Chinedu, n.d,). A way out in addressing this problem would be Open and Distance Learning (ODL). Very unfortunately, not many teachers appear to be aware of the trends in developing and utilizing learning technologies that speak to the needs of the 21$^{3'}$ Century Nigerian students. Pertinent questions to be addressed regarding these observed challenges in secondary schools may include, but not limited to the levels at which students could be assisted to significantly learn independently using instructional resources in and out of class environments. This therefore, speaks to the need for developing and using learning resources that is compatible with the ODE provisions. Another issue is the way educators can transform the attitude of self-learning among secondary school students in especially remote areas where not so much face-to-face learning resources are available. Again the production and use of animated instructional visuals would go a long way in cultivating this ideal in the learners, if properly explored and harnessed. Almost everywhere in the world, students of this generation are fun of the hand-held technological gadgets through which all kinds of social networking take place, which often pre-occupy their minds. The challenge and call to teachers is on, how they could harvest these potentials of the young minds, cultivate in them positive attitude that can translate most of their social networking and watching of non-educative movies into useful academic engagements. To this effect, it is thought that animated visual resources when properly used could help. Motivating the teachers to engage

in productive ventures such as preparing captivating animated instructional resources that may help supplement the shortage of teachers in especially science and TVET subjects in rural communities through open distance learning schemes is yet another point of concern in this study. Thus, this study designed to:

1. Develop an animated instructional resource (AIR) that can be used in teaching concepts of human digestive systems to secondary school students.
2. Pilot test the developed AIR to ensure its functionality.
3. Determine and compare students' achievement across educational zones.

METHODOLOGY

The study adopted an approach considered under Research and Development paradigm as "Instrumentation or Instructional Resource Development" (Shabani and Okebukola, 2001 and National Institute of Technical Teachers' Training and Research, Bhopal, n.d.). In this approach, instructional resources, curriculum materials, computer software, digital learning technologies such as videos, DVD/CD, games etc. are developed, tested, produced, packaged and shared. The approach is based on the system approach theory advocated by Dale (Heidi Milia Anderson, n.d.). AIR was conceptualized, developed and piloted in this context. The study centered on the human digestive system as enshrined in the Senior Secondary Schools (SSS) Biology syllabus. The production and testing of the AIR was aimed to supplement scarce instructional resources in Science Education and by extension TVET. The initiative was also meant to support the teaching of such subjects via in-class as well as by ODL schemes in Bauchi State. To the best of the researchers' knowledge, none of such initiatives exists in Bauchi State, at least in this subject at this level of education. Thus, the study was conducted in three educational zones of the state namely: Bauchi, Katagum and Ningi. Two SSS were selected from Bauchi zone, while Ningi and Katagum zones had one school each making a total of four. The respondents comprised of 504 students, out of which 252 each were randomly sampled and used as Control and Experimental groups respectively, Using the traditional normal chalk and talk system, both groups were first taught human digestive system in their biology classes based on the syllabus supplied by the Ministry of Education. After that lapse, the experimental group was given the opportunity to learn further the same digestive system taught with the support of a video packaged contained in the AIR. Both groups were then combined in a class and given multiple-choice test. The test papers were graded and the scores for both groups were compared. One null hypothesis was tested to ascertain whether or not significant differences existed between the two groups in terms of academic achievement across the educational zones. The procedures followed in developing AIR is summarized and outlined below:

Steps in Developing the AIR

The following activities were carried out:

1. Pictures were sourced from the Internet using free Google images, and through using digital still picture cameras.
2. These pictures were scanned and used.
3. Complex pictures were illustrated into line drawings in full colours for easy of understanding and for creating mood bearing in mind the level of understanding of the targeted students.
4. Lesson notes indicating the steps and approaches to the topic were developed and used.
5. Each topic was introduced with definitions of major terms outlined.
6. Development of the animation was carried out in three segments.
7. A production script was developed and used for the audio narration.
8. The digestive activities from the human mouth to the large, small intestine through to the rectum and the anal cavity were respectively narrated.
9. Other parts of the digestive system were placed as static pictures to enable students to study the structures as they watch the animated video clips.
10. A storyboard that introduced scene-by-scene major captions of activities was developed and used.
11. A video clip was produced, edited and packaged in a DVD.

Editing of the Draft AIR

1. To start the creation of animated illustrations of the instructional resource, sketches of the still images of key frames were made each on a separate piece of paper and scanned and saved in a computer in relevant file format.
2. The scanned files were then edited and scaled using Corel Photo Paint software.
3. A cleaned single and distinct line drawing was achieved and further processed with an "Anime Studio Pro" software.
4. Key frames were manipulated by shifting them forward or backwards where replication of the frames were needed, and subsequently copied and pasted on other parts of the timeline as desired.
5. After bits of animated strips were fully made, the strips were then exported as video files and saved in a folder for further editing.
6. Each file/folder was named for easy identification and sorting out.

7. Windows Movie Maker software was used to import all the animated movie strips, which were then assembled in the provided video timeline.
8. Visual effects/transitions were appropriately added before every successive video strip.
9. Labeling was done using character generator and the keyboard with the strips put in place.
10. Syncing and synchronization of the off-synced clips were done.
11. Audio tracks recorded were then added to the sound tract and adjusted to tally with video.
12. The animation was then played several times, inspected and the errors and omissions corrected.
13. The fully corrected clip was then written on a blank DVD.
14. The DVD was then tested using different players for final adoption as an instructional media suitable for use in schools and homes.

Application of the AIR

The animated instructional resource was designed to facilitate learning and improve literacy level among Nigerian senior secondary school students. AIR offers a wide spectrum usage that is friendly to classroom and open distance learning/teaching, home use and for assignment from teachers to students through interactive video via the use of media equipment (computers, DVD player, projector screen, video sender via TV monitor, Smart phones and other mobile devices). See diagramme 1.

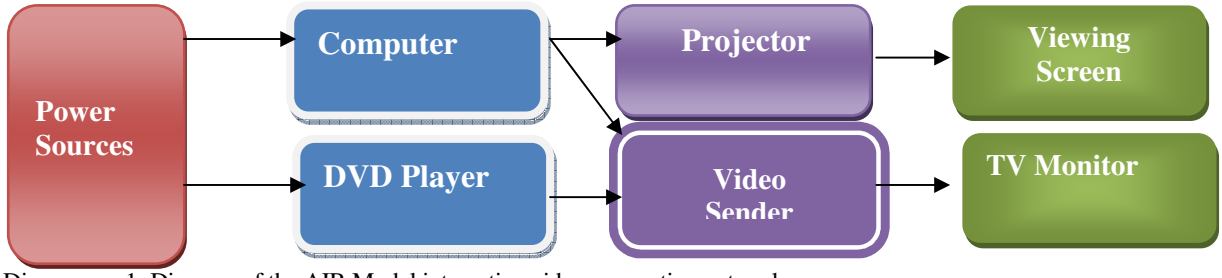

Diagramme 1: Diagram of the AIR Model interactive video connection network

RESULTS

The AIR was tested only on the experimental group, through which they were exposed to the content of the DVD. This happened after both groups had been taught the topic human digestive system in their biology class based on the syllabus supplied by the Ministry of Education through their regular teachers. Both groups were then given a multiple-choice test on the topic. The test scripts were graded and the percentage and achievement scores for both groups were compared. Summary of the grades for students from each of the schools selected from the three educational zones in Bauchi State and used in the experiment are presented below:

1 Out of the 63 participants from the experimental group that were tested in Urban College, Bauchi, 13 of them which is an equivalent of 21% got an "A" grade, whereas, no candidate within the other 63 in the control group got an "A" grade. Also 18(28%) and 6 (9%) of the experimental and control groups respectively got a "B" grade. On the other hand, 5(8%) from the experimental group and 25(40%) from the control group respectively had a failing grade "F". Other students obtained varying grades of "C", "D" or "E" respectively in that school.

2. It was also discovered that, 16(25%) and 7(11%) of the experimental and control groups respectively obtained an "A" grade. It also shows that, 24(40%) of both the experimental and control groups respectively obtained a "B" grade. On the other hand, 6(9%) and 9(14%) of the experimental and control groups respectively had an "F" grade in that school. Other participants obtained various grades ranging between "B" to "E".

3. For the experimental group tested in GSS Azare, 7 (11%) of the 63 participants got an "A" grade whereas; no candidate in the control group got an "A" grade. Also, 19 (30%) and 6(10%) of the experimental and control groups respectively got a "C" grade. On the other hand, 9(14%) from the Experimental group and 36(57%) from the control group respectively had an "F" grade. Other participants obtained varying grades ranging between "B", "D" and "E".

4. Similarly the result also shows that, 18 (28%) and 6(10%) of experimental and control groups respectively obtained an "A" grade, where as 12(12%) and 22(35%) of the experimental and control groups respectively had an "F" grade in that school. Other participants obtained various grades ranging

between "B"-"E".

Table 1: Comparison of Students' Achievements in the Multiple-Choice Test for Experimental and Control Groups in all the Three Educational Zones Combined

Grades	Experimental		Control	
	(f)	(%)	(f)	(%)
A	54	21	6	2
B	54	21	14	6
C	59	24	32	13
D	31	12	33	13
E	22	9	46	18
F	32	13	121	48
Total	252	100	252	100

Based on the data in table 1, when the numbers were put together, 54 (21 %) of the students got an "A" grade from the experimental group, whereas, only a total of 6 persons (2%) from the control group got an "A". Similarly, only 32(13%) in the experimental group failed as against 121(48%) in the control that got an "F" grade.

From the above, it is interesting to note that in each location, the average performance of the control group was discovered to be less than that of the experimental group, which is a clear indication that the new technique of teaching had great impact in the performances of the students. This shows clearly that, differences existed in the mean achievement by the experimental and the control groups in all the schools studied. The major factor responsible for the difference was the exposure of the AIR to the Experimental groups and the non-exposure of it to the control groups. This result corroborates the findings of Colley. (1990) in Nwosu (1994), which reveals that interest and learning by students treated to multimedia visuals could be higher than when taught by the formal traditional chalk and talk method only. It was also considered necessary to determine if observed differences between the groups were significant. Thus, using one-way analysis of variance, two null hypotheses were tested in this regard. The outcome showed that the performances of students in both the control and experimental groups differed significantly between the schools across the educational zones in the state.

Summary of Findings

Findings of this study revealed that the experimental group out-performed the control group in the test in all the three educational zones. This implies that the animated instructional package helped to improve the performance of the experimental group. The outcome therefore is that, besides using the AIR to facilitate in-class teaching and learning, there is also an indication that, it can be used to help students improve in their capacity to independently learn material in a way when delivered to them on an open distance approach setting as well. The result also shows that when students are presented with rich learning resources, they could on their own cultivate the attitude of self-learning, and would learn and achieve greatly. This finding confirms what the National Educational Technology Centre, Kaduna has been advocating for. Also if teachers could learn how to, and actually build into their curriculum the art of developing and using learning technologies such as the AIR model, a resource which could be uploaded into digital mobile devices, this can help motivate students positively against watching of socially harmful, morally destructive movies. These findings are in tandem with those of Yalams, Martin, & Lewis, (2012) and Yalams, Aliyu, Kwasu, & Abdul amid, (2012).

Recommendations

Based on the findings of the study, the paper recommended that:

1. The Animated Instructional Resource model be applied in other States of Nigeria to compare further its effectiveness.
2. The AIR model be tried in real life teaching and recommendation should be made to government for adoption and its use in school.
3. The developed instructional resource (AIR) be subjected to further research to improve its quality, wider usage and impact in the State.
4. This model be used among science and technology teachers as a catalyst to create similar models for blended learning environments.

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