IMPACT OF COMPUTER ANIMATION LEARNING ON STUDENTS' ACADEMIC PERFORMANCE IN AKWA IBOM STATE COLLEGE OF EDUCATION, AFAHA NSIT.

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Abstract

This study intends to determine the impact of computer animation on student's academic performance in Educational Technology with different levels of achievement and learning styles. Two specific purposes and two research questions guided the study. This study utilizes a quasi-experimental design. A sample of one hundred and sixty 200 level students from six schools in the College of Education, Afaha Nsit was selected for the study using purposive sampling technique. Three instruments were developed for the study: the Students' Performance Test (SPT), Students' Aptitude Test (SPT) as well as Animation instructional Test (ANIT). Data collected were later analyzed using inferential statistical methods, through Two-Sample T-Test and One-way ANOVA. The findings from this study show that, the computer animation learning courseware had given a positive effect on student's academic performance. The findings from this study also showed that learning through computer animation has significant effects on students' achievement (high and low prior knowledge) and their learning styles. These results indicate that learning through computer animation, utilizing systematic theory and development design are able to bring positive effects on students, irrespective of the different learning styles and degree of achievement.

In recent years, there has been a growing trend across a range of media to use highly illustrated materials for instruction rather than relying on largely text-based presentations of information. Learning in some schools is still structured on traditional chalk-and-talk methods and based on teacher directed approach. One way to bring about a change of emphasis in teaching, from these approaches to a facilitated approach, is to change the medium of instruction (Kearsley, 2000; Kiili, 2005).

Multimedia offers an alternative medium of instruction to the current learning process. With the rapid progression of computing capacities and the progress of graphic design technologies, multimedia learning environments have evolved from sequential static text and picture frames to increasing sophisticated visualizations. The nature of interactivity and discovery in multimedia learning bears a beneficial boost to the monotony of passive learning (Mayer & Sims, 1994; Mayer, 2000). Both teacher and students may control their own paced of lesson according to his or her own ability.

Multimedia can give low ability students extensive learning time before moving forward.

Alternatively, high ability students can branch out to random sequencing through the module and not be confined by linearity or a much slower pace (Mayer, 2001; Mayer & Moreno, 2003). This aspect of multimedia learning supports student-centred strategy whereby learners take responsibility for their own learning process (Clark & Mayer, 2003). The liberty to proceed or recede allows self-pacing, an important facet to enable learners to learn according to their individual pace. (Moreno & Mayer, 2000). To Mayer (2000) multimedia involves the presentation of the learning material using both

pictorial form and verbal form such as spoken and printed text. Through it, instruction may include motion, voice, text, graphics and still images (Moore, Burton & Myers, 1996).

With the newer technologies of instruction, this increasing reliance on pictures as a central part of instruction is not limited to static illustrations but also includes animations (Rieber, 1994) that is defined as images in motion(Dwyer & Dwyer, 2003). Animation capable features are innovations which can enliven the learning experience. Kearsley (2002) studies show that students who learn from animation have greater self-esteem and motivation. His studies also show that students may retain information and sustain the learning process increases. According to Reeves (1998), animation learning can stimulate more than one sense at a time and that may be more attention-getting and attention-holding.

Evidence is also accumulating that the instructional effects of animations may not always be beneficial (e.g. Schnotz, Bo¨ckheler, & Grzondziel, 1999;Schnotz&Grzondziel, 1996), thus whether or not instructions using animation can facilitate students learning achievement still remains a question. This study attempted to examine the effects of animation on student performance with different levels of achievement (high and low ability)and learning styles (linear and non-linear) in Educational Technology.

Research Purpose

The major purpose of this research was to determine the impact of animation on students' academic performance. Specifically, the study sought to:

1. Determine the academic performance of students based on different levels of achievement (high and low levels of prior knowledge)
2. Investigate the academic performance of students based on learning styles (linear and non-linear).

Significance of the study

The findings of this study will be of significance in various ways. It will contribute to the existing knowledge about the use of animation and its immense benefits to the learners especially in this part of the globe. Instructional designers and researchers would find the empirical findings useful in that the finding would become reference points for further research.

Research questions

Two research questions guided the study:

1. Does animation improve the performance of the students with different level of achievement?
2. Are there significant differences in the performance of the students with different level of prior knowledge and performance of the students with different learning styles through computer animation based-learning?

Related Literature

Theoretical framework

Some theories that are relevant to this work are**:**

Information Processing and Dual Coding

Information processing theories describe human brain as similar to a computer and human learning as similar to how computer processes information (Chandler & Sweeler, 1991).

There are three main storage structures in the memory system (1) sensory register, which registers stimuli in the memory system; (2) short-term memory (STM), which serves as temporary storage; and (3) long-term memory (LTM) where information is permanently stored. Short-term memory can only hold five to nine chunks of information (Miller, 1956)before it is processed in LTM. Not all the information stored in the LTM can be retrieved.

Retrieval is more likely when appropriate cues are provided in the encoding process(Driscoll, 1994).

Pavio's (1986) dual coding theory states that there are two separate information processing systems- a visual system which processes visual knowledge and a verbal system which processes verbal knowledge. According to Paivio (1986); Riber (1994)animation that combines visual and verbal knowledge may store information into long-term memory thus facilitates encoding and retrieval process. Dual coding theory also suggests there are three distinctive levels of processing that can occur between the verbal and visual system: representational, associative and referential (Rieber, 1996). Representational processing connects the incoming stimuli from the environment to either the verbal or visual system. Associative processing constructs connections within either of the verbal or visual systems, and referential processing builds connections between the verbal and visual systems (Rieber, 1994).

Conceptual framework

Conception of Animation.

Baek and Layne (1988) define animation as the process of generating a series of frames containing an object or objects so that each frame appears as an alteration of the previous frame in order to show motion. Gonzales(1996) proposed a broader definition of animation as a series of varying images presented dynamically according to user action in ways that help the user to perceive a continuous change over time and develop a more appropriate mental model of the task. This definition however contained the idea that the user interacts with the display (even minimally by hitting any key).It does not stipulate what the animation is supposed to convey, and it separates the issue of animation from the issue of interaction.

According to Schnotz and Lowe (2003), the concept of animation can be characterized using three different levels of analysis: Technical, semiotic and psychological. The technical level refers to the technical devices used as the producers and carriers of dynamic signs. With the evolution of the computer graphics industry, distinguishing between events captured by way of a camera or events completely generated by computer is becoming harder and irrelevant to learning issues. Second, there is a semiotic level, which refers to the type of sign which is the kind of dynamics that is conveyed in the representation. This includes concerns about what is changing in the animation and how (e.g., motion, transformation, changing of points of view). Third, there is a psychological level, which refers to the perceptual and cognitive processes involved when animations are observed and understood by learners.

Animation as an Aid to Information Processing

Previous studies revealed that animation had facilitated the learner encoding process than static visuals (Lin, 2001). Rieber, Boyce and Assad (1990) suggested that animation helped decrease the time to retrieve information from long-term memory and then subsequently reconstruct it in short-term memory. Reiber (1990) further explained that animations facilitate the reconstructing process during retrieval by encouraging organization. Mayer (1994) in his study showed that computer based animations can be used to promote scientific understanding. It was also found that students performed better on recall and problem solving test when both the verbal and visual systems were utilized. Chuang (1999) in his study found that student with different gender and learning styles (field dependence/ field independence) perform on the ability to solve learning problems.

Animation with a support of text had reduced cognitive load of students (Mayer, 1996). His research found that animation complemented with a textual explanation enabled students to take greater advantage of their capability to process information on two levels by stimulating the visual system and by reducing the load placed on the verbal processing system. This reshuffling of information in working memory increased their ability to make meaning out of the information in preparation for storage in long-term memory. The placement of the supporting textual explanation next to the animation further reduced cognitive load and enhanced performance (Mann, 1995; Moreno, 1999; Lai, 2000). Students will be guided to learn by sifting the relevant from the irrelevant information and can relate new information to real world situations (Stoney& Oliver, 1999).

Student Prior Knowledge

Prior knowledge has been considered the most important factor that influences learning (Ausubel,1968; Bloom,1994). Jonassen and Grabowski (1993) define prior knowledge and achievement as the knowledge, skills or abilities that the learners bring to the learning environment before the instruction. Dwyer (1994) further classified students' prior knowledge into high and low level. Hannafin (1997) suggested that compared to individuals who have lower prior knowledge, individual who have higher prior knowledge can quickly determine their own learning needs, generate their own learning strategies and assimilate new information to their existing knowledge structure. Rieber (2000) also stated related prior knowledge provides the learners unique relevant elaboration that is unavailable to learners with limited prior knowledge. It is suggested that knowledge will be encoded more meaningfully and retrieved more easily by learners with high prior knowledge.

Mayer and Anderson (1992) found that learning significantly improved students who possess low prior knowledge when verbal and visual information are presented simultaneously. They suggested that experienced students might be able to build referential connections between verbal and visual information and their existing knowledge on their own. The computer-based instruction utilized in this study presented verbal (the text) and visual (the graphic illustration or animation) information simultaneously. One of the purposes of this study is to investigate if varied animation strategies will improve the performance of the students identified as possessing low levels of prior knowledge.

Learning and Thinking Styles

The term learning and thinking style refer to the characteristic ways in which individuals conceptually organize their environment. This will influence how students learn, how teachers teach and how teachers and students interact in the classroom (Yu-ping Hsiao1997; Witkin1977). According to Raven, Cano, Garton & Shelhamer (1993) given that students learn in different ways,

instruction should be designed in such way that can accommodate different learning styles. Several classifications of learning and cognitive styles have been proposed by Dunn and Dunn (1978), Felder (2000), Gardner (1993) and Kolb (1984).

Witkin and Goodenough (1979) had developed a concept of field dependence (FD) and field independent (FI) cognitive styles that been defined as the extent to which a person perceives part of a field as discrete from the surrounding field. According to Summerville (1999) FD and FI is a global versus an articulated styles that reflected to the degree to which an individual's processing of information is affected by the contextual field. FI learners have been referred to analytical, competitive, individualistic, task oriented, internally referential, self-structuring, linear, detail oriented, global sensitive to social, interaction, passive learners that prefer external information structures (Hall, 2006).

Methodology

The research methods and procedures that were used in carrying out the study are:

Research Design

The design that was adopted for this study was the quasi-experimental design, which involved a pre-test and a post-test based on the factorial 2x2x2 design. Through this method, the research is able to manipulate or exercise control on the variables (MohamadNajib, 1999). Gay (1992) advocates that this design will involve at least two randomly formed groups on which a pretest functioning as dependent variables is administrated.

Sample and Sample Technique

One hundred and sixty 200 level students from six schools in the College of Education, Afaha Nsit participated in the study. This level were selected using purposive sampling technique because it is only in this level that Educational technology is offered as a course of study in the college.

Instrumentation

Three instruments were developed for the study: the Students' Performance Test (SPT), Students' Aptitude Test (SPT) as well as Animation instructional Test (ANIT). The SPT test was administered to determine the students' respective cognitive styles group and to determine their existing achievement levels. This was followed by the administration of the ANIT a day after the samples had participated in the specially developed web-based learning session. The Students' Aptitude Test was a test designed and administered to ascertain whether the students fell in the high or low achievers' groups.

Validation of Instruments

The drafts of the instruments were submitted to two experts in Educational Technology and three experts in Measurement and Evaluation for face and content validation.

Reliability of the Instruments

To establish the internal consistency, the instruments were subjected to reliability test using students of this level who were not part of the study

Research Procedures and Administration.

Research procedures to this research can be generally divided into seven main stages which are as follows:

Stages 1: The researcher designed a computer animation based learning package. The content of package was taken from the 200 level Course outline on EDU212-Educational Technology: Theory and Practice. The development and creation of the computer animation based learning package incorporated Gagne's nine Events of Instruction to be considered a good lesson design (Ellington and Earl, 1999).

Stages 2: All research items designed (including the learning materials developed by the researcher) were first evaluated by experts.

Stages 3: The SPT test was administered to determine the students' respective cognitive styles group.

Stages 4: The students were further divided into two main groups: high achievers and low achievers. The division made was according to the students' grades as well as a Student
Aptitude Test (SAP) designed by the researcher.

Stages 5: The number of the student samples was then given the pre-test which is to determine their level of knowledge before being treated with the learning process suggested.
The marks of the test were noted to enable cross comparisons with the post-test results.

Stages 6: At this stage, the entire sample group had undergone the web based learning process through their respective learning styles (linear and non-linear) which were predetermined by the researcher.

Stages 7: The students are given a post-test. The scores of this post-test are compared against the pre-test scores to see the effects of linear and non-linear learning styles onto the teaching method developed.

Method of Data Analysis

All data obtained were analyzed using the statistical methods found in the SPSS software which catered to the research questions and objectives. The data were analyzed using T-Test and one way ANOVA. The Two-Sample t-Test was used to determine the difference in means for both dependent variables. The One way ANOVA was applied to simultaneously test the difference between means of two or more groups of dependent variables.

Result and Findings

Two-Samples T-Test was used to test the differences in student achievement between those who chose linear learning methods and those who used the non-linear or web-based learning method. The significance level used to test the statistical significance is 0.05. The findings of this test indicate that 91 students choose the linear learning style (m=4.49) as compared to 69 students that choose the non-linear styles (m=4.29). The findings also reveal that there were no significant differences (p=0.559) between the performance of students who chose the linear learning styles as compared to students who choose nonlinear learning styles.

The research findings also looked at the difference between student performances with differing cognitive styles through linear learning styles as compared to the student performance with differing cognitive styles through non-linear learning styles. Division of the groups through different cognitive styles: Field Dependent (FD) and Field Independent (FI) were also carried out. This was then followed by the division of student group based on their performance levels (high and low achievement) as well as their learning styles (linear or nonlinear).

After conducting an analysis through One-way ANOVA with a significance level of 0.05, it was revealed that the p value stands at 0.156. This indicates that there is no significant deference between the performance of students with different learning styles(non-linear) and cognitive styles and the performance of students with different learningstyles (linear) and cognitive styles.

Conclusion and Discussion

This study attempted to examine the impact of computer animation on student's academic performance. The study showed that students with lower prior knowledge performed equally well to those with high prior knowledge. This result was contrary to much previous research that showed high prior knowledge students perform better than low prior knowledge students. Based on dual cording theory, students with low prior knowledge are helped more when verbal and visual information is presented simultaneously since it helps them build referential connections (Mayer & Anderson, 1992). By rearranging the layout of the instructional text and static visuals, the animations were put side by side instead of static graphic on the top and instructional text at the bottom. This layout would encourage the learners to read the instructional text as well as build connections with the static graphic or animations. There was a significant difference between the high and low prior knowledge students in the pre-test, but the differences were obviously reduced to insignificant differences in the achievement tests after they went through the computer animation based learning.

The result of the interaction between level of prior knowledge and learning styles provides an important contribution of the effectiveness of animation towards student's academic performance. Insignificant differences were found between students with different level of achievement. The results showed that the linear based learning styles performed equally as well as the non-linear based learning. This overall finding continues the debate about the value of animation in presenting a concept of teaching. Visualization, included in all treatments seemed to be a powerful factor in learning this multimedia teaching material. The results were in accordance with many previous literature and animation related studies with different level of prior knowledge. Clark and Mayer (2003); Penny (1989) justified the modality effect which states that students learn more deeply from multimedia lessons when words explaining concurrent animation rather than onscreen text using coordination presentation of explanation in visual format. Wilson (1998) found a general tendency of the mean score for the static treatment produce somewhat better result than any dynamic treatment. Owens (2002) found a trend that the students' performance decreased as animation strategies were added to the instructional screens. Theoretically, the results of the study strengthened the results and conclusions of some of the previous animation related studies. Practically, the results also raised a very important question to the practice of instructional designer, it is it really worth it to design and develop instructions utilizing animation.

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