Full Length Research Paper

Enhancing students interest in mathematics via multimedia presentation

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Alarming statistics in mathematics education in Nigeria indicated that very few or almost none of the students in high school fancy taking up a course in mathematics in the University. Moreover, less than ten percent of these students enjoyed lessons in mathematics. Additionally, cultural and racial prejudice as well as poverty are serious issues confronting many of today's high school students, thus a set of thirty numerical equations to solve would not be top priority. Consequently, mathematics teachers have sought to determine how they could possibly capture the attention of teens distracted by serious problems and events in their daily lives. Although educators have made some efforts towards improving these trends, students' disinterest in continuing mathematics study beyond secondary school level is still a tremendous problem. In this paper, student preference of multimedia presentation in mathematics education as opposed to traditional instruction was investigated for high school students learning mathematics. The survey instrument presented a 5-point Likert scale with students rating 17 statements associated with acceptance of the presentation. Results from the survey carried out indicate that multimedia presentations can improve students' understanding, enthusiasm, class attendance and satisfaction.

Key words: Class, high school, instruction, interest, mathematics, multimedia, student, teacher, traditional, University.

INTRODUCTION

The process of learning mathematics is a very complex cognitive task that can be very imposing on students since it requires a lot of effort from them. Consequently, these students need a lot of motivation to cope with the subject. It is therefore within the benefit of education to produce instructional strategies that are interesting and stimulating. Educators are now introducing more and various forms of software and multimedia presentation driven media into their classroom activities (Tolhurst, 1995). These creative presentation systems are producing a great deal of excitement among educators.

Multimedia can be described as "the combination of various digital media types, such as text, images, sound, and video, into an integrated multisensory interactive application or presentation to convey a message or information to an audience." It certainly has the potential to extend the amount and type of information available to learners. Well-designed multimedia helps learners build more accurate and effective mental models than they do from text alone. Recent surveys indicate that students enjoy attending classes that utilize multimedia presentations because they find these classes to be more interesting and exciting with multimedia. Multimedia offers remarkable opportunities and challenges for teaching mathematics. Hence, it is pertinent that Mathematics educators examine the opportunities and challenges of new technologies in order to enhance their teaching styles. Multimedia is made up of a number of communication channels; each having their own advantages and disadvantages. Velleman and Moore (1996) report that in order for any multimedia system to be successful, these channels must be in balance; using each for what it does best and not letting one channel dominate over the others. One of the greatest benefits of the first communication channel, video, is its ability to take students beyond the classroom. Video can focus our

attention through editing, and can manipulate time and space through time-lapse, slow motion, microscopic, or telescopic views. When these tools are used properly, a video presentation can be more compelling than direct observation.

Animation is another communication channel of multimedia. Animation can be defined as making objects on the screen change or move in real time. Research has shown that motion on the screen is important to holding viewer attention. Because of this, animation plays a major role in multimedia design. A third channel of multimedia is narration. When it comes to narration, it appears as if engineers of multimedia have overlooked the value of oral presentations. A spoken narrative can be very effective in attaining attention when illustrated with animations and accompanied by an outline of key points. Finally, one of the last multimedia channels is sound. The use of sound goes beyond narration with the ability to enrich the multimedia environment. Sound effects can contribute validity to animated objects or they can lighten the mood of a presentation that has grown too serious. In addition, sounds can make mnemonic morphs more memorable.

RESEARCH OBJECTIVES

The specific objectives of the study were:

1. To identify the variation in multimedia presentation attitudes and preference within a group of high school students learning mathematics as measured by a survey instrument.
2. To determine if the number of respondents preferring the multimedia presentation was significantly different from the number of respondents preferring traditional instruction.

LITERATURE REVIEW

In their studies, some researchers suggest that the use of technology in the classroom can enhance student learning. Twenty years of research show that multimedia enhanced learning produces at least 30% more learning in 40% less time at 30% lower cost. When a multimedia presentation is used for multimedia methods of instruction, retention is raised to 80% in contrast to 40% for discussion methods or 20% with the traditional lecture approach using visual aids (White and Kuhn, 1997). A study performed by Butler and Mautz (1996) examined the impact of a multimedia presentation on recall in a controlled setting. The results indicate that multimedia leads to more positive attitudes towards the presenter and presentation style associated with multimedia. Students in the multimedia group enjoyed the presentation more, found it more understandable and believed that it taught them concepts better than did the students in the traditional group.

Other researches show that students are more motivated and attend class more regularly (Butler and Mautz, 1996). A growing body of research has identified students choosing to take different paths and using different media while acquiring information that allows them to perform at equivalent levels. When an investigation of students' choice of media from within a hypermedia program was researched, results concluded that 56% of the students chose visual media, 30% chose text, while 14% chose auditory media (Ayersman, 1996). Multimedia presentation technology provides an influential and multifaceted tool that can change the way we teach and the way students learn. In turn, there is an improved ability to search for abstract or complex material with increased student comprehension and interest (Matheson and Achterberg, 1999). Instructors should consider the nature of technology and the potential range of its uses in higher education. One potential use of multimedia presentation in high school is to complement traditional instruction. This is accomplished by integrating a variety of media sources such as words, graphs, sound and visuals. The result is an improved ability to present abstract or complex material with increased student comprehension and interest (Kolasa and Miller, 1996). An expert in developmental education performed a meta-analysis of 500 individual studies examining the effect of multimedia presentation-aided or multimedia presentation-based instruction. The researchers concluded that students usually learn more in classes in which they receive multimedia presentation-based instruction and that they learn their lessons in less time with multimedia presentation based instruction (Skinner, 1997). Presentation programs offer college teachers the possibility of preparing educational materials that combine the visual as well as the auditory modes of learning. If the presented materials read clearly, the design incorporates a visual analogy, and the graphic presentation uses sound principles of emphasis and harmony, multimedia presentation-enhanced instruction can dramatically portray new ideas (Gribas et al., 1996).

Research shows significant links between multimedia instruction and achievement in traditional subject matter. Schools that integrate technology into the traditional curriculum have higher student attendance and lower drop out rates, which leads to greater academic results (Fisher, 1999). It is believed that technology will continue to increase and become a standard part of the educational model. As this occurs, educators will have to put some of their traditional teaching techniques to the side to make room for multimedia. The old model of student note taking has been shown to be unsuccessful in making efficient use of lecture time for allocating information to large groups of learners or for learning by students with diverse backgrounds and skills (Nantz and Lundgren, 1998). Another advantage of using various forms of multimedia is that complicated topics can be explained and understood better with the aid of pictures,

graphs, animations and simulations (Kussmaul et al., 1996). Yet another benefit of multimedia is the option to present complex concepts in small, chronological steps as a means to improve students' ability to comprehend information in a meaningful way. This concept is especially important for introductory classes that have students with assorted backgrounds and interests. Compared to the traditional presentation methods, multimedia has the capacity to offer instructors control over how and when information is presented to students (Beerman, 1996). Researchers found that college students taught by interactive multimedia had greater long-term retention compared to students taught by traditional classroom methods (Beerman, 1996). The same research concluded that from the students' point of view, multimedia is effective. Beerman also observed that students taught with multimedia attend class more frequently and appear to be more interested than students taught without multimedia. Additional findings from a study conducted by Fitzgerald and Semrau (1998) support the belief that hypermedia is good for instruction. Undergraduate and graduate students who made use of the comprehensive hypermedia environment demonstrated that they could and would modify the use of their programs. It is evident that educational technology and electronic multimedia will continue to grow at a rapid rate. Lectures that were once supplemented with chalkboards can now be complemented with a large screen projection system that can handle the multimedia presentation and the Internet (Nantz and Lundgren, 1998). With newly developed presentation software, educators are able to place their lectures onto the multimedia presentation, along with new graphics and sound to create an engaging classroom presentation (Fisher, 1999).

Further literature review indicates that multimedia presentation enhances class discussion. For example, preparing discussion questions ahead of time and incorporating them into the lecture screens has been shown to improve discussion. In an effort to make students pay more attention to discussion, the instructor types the students' answers into the notepad space of the screen. Having their answers written on the screen appears to increase the importance of the questions and, thus students are less likely to tune out and not participate in discussion (Sotone and Mayer, 1999).

Research suggests that students will try to write everything presented, even if they are told that it is not necessary or that it is in the book. A better approach would be to use multimedia presentation to develop a note outline containing some of the materials with space for students to write other things. This has the dual advantage of saving copying time and of helping students to organize notes. The final product is a clearer set of notes (Sotone and Mayer, 1999). Another researcher identifies the use of hypermedia as an instructional resource being compared to alternative instructional strategies where more traditional methods (lectures) have been used.

Conclusions from comparative studies range from no significant difference in students' performance levels to differences significantly favoring the use of hypermedia-enhanced instruction (Ayersman, 1996).

METHODS

In order to identify students' preference for multimedia-based mathematics instruction as opposed to traditional instruction. A survey instrument was developed to enable us gather required information.

Subject selection

Those involved in the study consisted of high school students learning mathematics. These students were asked to voluntarily complete a presentation survey to evaluate their preference of a specific presentation method. Each student was advised that their participation was strictly voluntary, reassured that they would not be identified and that there would be no repercussions for not participating.

Survey instrument

The survey instrument (Appendix A) provides a four number code for matching surveys collected throughout the term. The presentation method evaluation scale presents as a 5-point Likert Scale in which seventeen statements are assessed. Students were asked to circle one of the following responses: 1= best accomplished by the multimedia presentation, 2 = good by multimedia presentation, 3 = each were about the same, 4 = good by traditional instructions, 5 = and best by traditional instructions. A section for additional comments was included at the bottom of the survey.

Research procedure

Throughout the term the students had experienced two types of presentation methods during the lecture period. The teacher alternated the presentation method for every other unit. The class teacher distributed the survey to the students at the beginning of the term, again at midterm and once again at the end of the term.

Data analysis

The presentation surveys were collected and examined. By the end of the term there were a total of 82 grouped subject surveys. The data collected via the survey instrument was statistically analyzed using the following measurements:

1. Frequency counts.
2. Means.
3. Percentages.
4. Standard deviations.
Independent group t-test on items 1 - 17 early in the term, at midterm, and at the end of the term.
5. One-way analysis of variance with a Student Newman-Keuls Multiple Range test on items 1-17 early in the term, at midterm, and at the end of the term using grade classification (freshman, sophomore, junior and senior) as the independent variable.
6. One-way analysis of variance with repeated measures on items 1-17 early in the term, at midterm, and at the end of the term for the single groups of respondents.
7. A one-sample binomial test between the proportions of

respondents preferring the multimedia presentation to the proportion of proportion of respondents preferring traditional instructions on items 1-17 early in the term, at midterm, and at the end of the term.

RESULTS

A total of 246 presentation surveys were collected from the high school students learning mathematics. There were a total of 82 respondents. The survey respondents were asked to evaluate the lecture presentation at the start of the term, mid term and at the end of the term. The survey instrument included the following seventeen statements associated with the acceptance of the presentation method used for alternating units:

1) Allowed for better understanding of the material, 2) Visual quality was easier to read, 3) Room lighting was most conducive to learning, 4) Facilitated interaction between student and instructor, 5) Made better use of examples and illustrations, 6) Increased skills, knowledge, and ability to think, 7) Held my attention longer, 8) Easier for me to comprehend and retain information, 9) Allowed for easier note taking, 10) Most attractive, 11) Most effective, 12) Allowed me to keep up easier, 13) Got my attention, 14) Stressed important and relevant information, 15) Best organized, 16) Overall, I prefer (type of presentation method) in this class, 17) Which presentation method would you prefer in other classes?

The statements were rated using a 5-point Likert scale. Means were determined by the following values: 1 = best accomplished by multimedia presentation, 2 = good by multimedia presentation, 3 = each was about the same, 4 = good by traditional instruction, 5 = best accomplished by traditional instruction. The results shown on Table 1 were statistically analyzed by using a one sample binomial test to evaluate the proportion of students that prefer the multimedia presentation enhanced mathematics education to the proportion of students that prefer the lecture utilizing traditional instructions early in the term, midterm and at the end of the term. When the students rated questions 1 - 17 early in the term, the most notable observation was the non-significant value reported for question number twelve; "allowed me to keep up easier" (p=.6650). Twenty-six students reported that they preferred the multimedia presentation, which was not significantly different from the twenty-two students who preferred traditional instructions. However, the sixteen remaining survey statements were highly significant, indicating that the students preferred the multimedia presentation to the traditional instruction presentation method at the start of the term as indicated in Table 1. The data from respondents at midterm indicate that students strongly preferred the multimedia presentation rather than traditional instructions on all seventeen statements. The same results are also seen at the end of the term with students once again intensely preferring the multimedia presentation to the presentation method of using traditional instructions. Throughout the term the student's strong preference for the multimedia presentation method did not change regarding the statement "most attractive". Data analysis of the survey statement "most effective" shows a strong tendency (p = 0.051) for favoring the multimedia presentation at midterm (mean 1.821) more so than early in the term (mean 2.156) or at the end of the term (mean 2.111). The student's preference of a presentation method regarding the statement "allowed me to keep up easier" leaned toward traditional instructions early in the term with a mean of 2.948 and slowly progressed to the preference of the multimedia presentation method at the midterm with a mean of 2.529 and at the end of the term with a mean of 2.403. From the start of the term to the end of the term there was no change in subject response to the statement "got my attention". Data analysis of the three time frames indicated that the students felt the multimedia presentation method was able to catch their attention more than the traditional presentation. Data with reference to the survey statement "stressed important and relevant information", shows a shift (p = 0.05) from preferring the traditional instruction presentation at the start of the term to a preference of the multimedia presentation in the middle of the term and end of term.

DISCUSSION

Student preference of multimedia presentation for mathematics education as opposed to traditional instruction was investigated for high school students learning mathematics. The survey instrument presented a 5-point Likert scale with students rating 17 statements associated with acceptance of the presentation. Throughout the term the students had experienced two types of presentation methods during the lecture period. The teacher would alternate the presentation method every other unit. The class teacher distributed the survey to the students on resumption for the term, again at midterm and once again at the end of the term. Approximately 82 surveys were collected each time throughout the term.

Based on the results obtained from this study the following conclusions are drawn. Of the eighty-two respondents, a significant difference was found in the following survey statements associated with the proportion of students that prefer multimedia presentation to those that prefer traditional instruction. "Allowed for better understanding of the material.", "Visual quality was easier to read.", "Room lighting was most conducive to learning.", "Facilitated interaction between student and instructor.", "Made better use of examples and illustrations.", "Increased skills, knowledge and ability to think.", "Held my attention longer.", "Easier for me to comprehend and retain information.", "Allowed for easier

Table 1. Proportion of students that prefer the multimedia presentation to the proportion that prefer traditional instruction.

Question	Early in semester			Midterm			End of semester		
	N1	N2	P value	N1	N2	P value	N1	N2	P value
Allowed for better understanding of the material	36	4	0.0001	43	3	0.0001	49	4	0.0001
Visual quality was easier to read	66	4	0.0001	61	0	0.0001	59	4	0.0001
Room lighting was most conducive to learning	31	10	0.0001	25	7	0.0027	38	9	0.0001
Facilitated interaction between student and instructor	20	8	0.0376	26	3	0.0001	35	8	0.0001
Made better use of examples and illustrations	68	3	0.0001	55	1	0.0001	57	7	0.0001
Increased skills, knowledge and ability to think	33	6	0.0001	35	3	0.0001	43	8	0.0001
Held my attention longer	49	8	0.0001	51	2	0.0001	56	9	0.0001
Easier for me to comprehend and retain information	44	7	0.0001	47	2	0.0001	44	8	0.0001
Allowed for easier note taking	47	14	0.0001	48	4	0.0001	49	13	0.0001
Most attractive	72	2	0.0001	60	1	0.0001	61	5	0.0001
Most effective	42	6	0.0001	44	2	0.0001	45	10	0.0001
Allowed me to keep up easier.	26	26	NS	26	9	0.0001	36	12	0.0001
Got my attention	60	2	0.0001	49	0	0.0001	59	6	0.0001
Stressed important and relevant information	33	6	0.0001	37	2	0.0001	44	7	0.0001
Best organized	56	5	0.0001	48	3	0.0001	53	8	0.0001
Overall, I___ prefer in this class	54	5	0.0001	52	3	0.0001	53	7	0.0001
Which presentation method would you prefer in other classes?	51	9	0.0001	50	3	0.0001	50	7	0.0001

Question Early in Term, Midterm, End of Term.
N1 N2 P value N1 N2 P value N1 N2 P value.
N1 = Students that prefer the multimedia presentation.
N2 = Students that prefer traditional instructions.
Means were determined:
Prefer the multimedia presentation = 1 (Best accomplished by multimedia presentation) + 2 (Good by multimedia presentation)
Prefer traditional instructions = 4 (Good by traditional instructions) + 5 (Best by traditional instructions)
Responses were analyzed by a one-sample binomial test.

note taking.", "Most attractive.", "Most effective.", "Got my attention.", "Stressed important and relevant information.", "Best organized.", "Overall, I prefer (presentation method) in this class.", and "Which presentation method would you prefer in other classes?" The students highly prefer the multimedia presentation over the traditional blackboard presentation method. Thus we conclude that multimedia presentation significantly boosts students' interest, involvement, enjoyment and liking for mathematics. Data analysis of this study also found that students feel that the multimedia presentation was better at helping them to keep up with the subject in contrast to the traditional presentation method.

CONCLUSION AND RECOMMENDATION FOR FURTHER WORK

The results of this study indicate that students prefer multimedia presentation to the traditional classroom instructional method. More research effort should be invested to explore student preference and learning with regards to other instructional methods such as web based learning and multimedia presentation-assisted instruction. Additional research regarding the influence of multimedia on different types of learning styles should also be investigated to determine how individuals with diverse learning styles benefit from multimedia instruction.

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APPENDIX – A SURVEY

Dear Respondent,

Please assess both presentation methods by marking your response for each question on the multimedia pre-sentation answer sheet. By completing this questionnaire you are giving your informed consent that data collected may be used in a research study. Your name will not be identified and there are no repercussions for not participating.

a = best accomplished by a multimedia presentation, b = each were about the same, c = prefer or best accomplished by traditional instructions.

1 2 3 4 5 Allowed for better understanding of the material
1 2 3 4 5 Visual quality was easier to read
1 2 3 4 5 Room lighting was most conducive to learning
1 2 3 4 5 Facilitated interaction between student and instructor
1 2 3 4 5 Makes better use of examples and illustrations
1 2 3 4 5 Increased skills, knowledge, and ability to think
1 2 3 4 5 Held my attention longer
1 2 3 4 5 Easier for me to comprehend and retain information
1 2 3 4 5 Allowed me to take notes easier
1 2 3 4 5 Most attractive
1 2 3 4 5 Most effective
1 2 3 4 5 Allowed me to keep up easier
1 2 3 4 5 Gets my attention
1 2 3 4 5 Stresses relevant and important information
1 2 3 4 5 Best organized
1 2 3 4 5 Over all, I prefer _____in this class
1 2 3 4 5 which presentation method would you prefer in your other classes?

Additional Comments
_____
_____