EFFECTIVENESS OF AN INTERACTIVE MULTIMEDIA LEARNING PACKAGE IN DEVELOPING ATTITUDE TOWARDS MATHEMATICS

By

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ABSTRACT

The present study has been designed to investigate the effectiveness of an interactive multimedia learning package in developing attitude towards Mathematics. After establishing homogeneity with reference to the students' quarterly marks in Mathematics and the scores of intelligence test, they were divided into 21 learners in control group and 21 in Experimental group. The selected topics from the standard IX Mathematics book was taught through traditional method to the sample selected for the control group whereas, experimental group was given treatment through Interactive Multimedia Learning Package developed by the investigator. Attitude towards mathematics inventory developed by the investigator was used to collect the data. Pre-test and post-test were conducted to both groups before and after the treatment. The data obtained were statistically analyzed by calculating arithmetic mean, standard deviation and t-test. The results indicated that, there is a significant difference in the posttest scores between the control and experimental groups with regard to the attitude towards mathematics.

Keywords: Multimedia Learning, Mathematics, Attitude Towards Mathematics, High School Students.

INTRODUCTION

The main aim of Education is to develop harmonious personality of learner. Education should make pupils fit to live with an environment. In all modern human societies, the young are prepared for their future roles through educational process which may be in the form of examination. Mathematics is a tool in which students and youngsters get knowledge and experience about life, they learn how to deal with problems, and apply their knowledge into real life problems. They improve their ability about logical thinking and reasoning, and they are getting ready for their future (Arslan et.al, 2012). Teaching of Mathematics essentially help the students in acquiring essential mathematics knowledge, skills, interests and attitudes. Kothari Commission has rightly pointed out that Mathematics should be made a compulsory subject for the students of 1st to 10th standard, as a part of General Education (Bishnoi, 2010).

A bi-dimensional definition, in which behaviours do not appear explicitly (Daskalogianni & Simpson 2000): attitude toward mathematics is therefore seen as the pattern of beliefs and emotions associated with mathematics. It is generally believed that, students' attitude towards a subject determines their success in that subject. In other words, favorable attitude result to good achievement in a subject. A student's constant failure in a school subject and mathematics in particular can make him/her to believe that he/she can never do well on the subject and thus accepting defeat. On the other hand, his/her successful experience can make him/her to develop a positive attitude towards learning the subject.

It is felt by a vast majority of people that, mathematics is a dry and difficult subject, full of abstract things. The result is that students take very little interest in it. Creating the necessary interest is a constant problem for the teacher. This subject demands the use of various aids and innovative methods in teaching. Technology is pervading all levels of mathematics teaching and learning in our modern world. The last two decades of the 20th century were marked by the advancement of technological aids in Mathematics Education. Graphing Calculators, Computer Algebra Systems, the World Wide Web, and more recent dynamical software paved the way for radical change in the way mathematics is taught. The variety of resources

available and the lack of readiness of instructors to utilize these resources prompted many National and International organizations to set standards for the use of technology as a teaching tool in mathematics classrooms. Education has thus adopted these technologies to see the better results in teaching and learning and everyone can see a sort of revolution in the field of education (Mangal, 2001). The research shows countless ways that technology can be the use to teachers in preparation for teaching in the classroom (Purabi, 2004). According to National Council of Teachers Mathematics, (2000), "technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning (p. 24). Also, many teachers lack the knowledge of how to properly incorporate technology in the classroom (Doering, Huffman & Hughes, 2003).

Defects in the Traditional Method of Teaching Mathematics

It should be frankly admitted that, the present-day teaching of mathematics is far from being satisfactory. This is not due to the drawbacks of any single agency at work. The entire set-up is to blame for this. In spite of the fact that it is taught compulsorily to all the students up to the tenth class, they do not become adept even in elementary arithmetic (Sidhu, 2006, p. 170). Learning is chiefly associated within the classroom and is often competitive. The lesson's content and delivery are considered to be most important and students master knowledge through drill and practice (such as rote learning). Content need not be learned in context (Johnson and Johnson, 1991). The larger population in the class is also a problem for the traditional teacher to control the students and make them to learn (Esakkiammal and Veliappan, 2014, p. 118). This poses a great challenge for teachers and educators, especially in the primary and intermediate levels, wherein a good study habit and a firm grasp of basic concepts should be developed. Hence there is a need of technology in teaching and learning process to create a student centered learning environment.

Review of Related Studies

Erbas, Ince and Kaya (2015) explored the effect of a technology-supported learning environment utilizing an Interactive White Board (IWB) and NuCalc graphing software compared to a traditional direct instruction-based environment on student achievement in graphs of quadratic functions and attitudes towards Mathematics and Technology. Comparisons suggest that although both experimental and control group students' performances increased from pre-test to post-test and then decreased from post-test to retention test, the rate of decrease was about the same and the rate of increase was different, with students showing a greater rate of increase in the experimental group. The results also revealed that the treatment had positively affected students' attitudes towards technology and mathematics. Alexander and et al. (2014) looked at the effect of content-specific, technology-rich project-based learning activities on EC-8 pre-service teachers' competencies and skills, as well as pre-service teacher's attitudes toward Science, Technology, Engineering and Mathematics (STEM). The findings provide evidence of changes in attitudes and skills of the pre-service educators after participating in the course. A specific focus is explored on the emerging relationships between STEM dispositions and technology integration competencies. Muhanna and Nejem, (2013) aimed to investigate the attitudes of mathematics teachers toward using a smart board in teaching mathematics and also to determine the effect of gender, experience, and qualification of teachers on their attitudes. The results of the study revealed that the mathematics teachers have positive attitudes toward using a smart board in teaching mathematics. Results showed that, there is no statistically significant difference due to gender variable; however, there were statistically significant differences due to experience variable and due to qualification variable. Pilli and Aksu (2013) examined the effects of the educational software "Frizbi Mathematics 4" on 4th grade student's mathematics achievement, retention, attitudes toward mathematics and attitude toward computer assisted learning. A series of ANOVAs for repeated measures revealed significant difference between the groups on the post achievement tests and attitude scales in favor of experimental group. However, statistically significant differences in favor of the treatment group, on the retention tests were attained on the

multiplication and division units; but, not on fractions. Hodges and Kim (2013) investigated the effectiveness of a treatment designed to improve the college algebra students' attitudes toward mathematics. Statistically significant results were observed for improved attitudes toward mathematics. Gibson and Bell (2011) explored the attitude to Mathematics of B.Ed. (Post-primary) Technology and Design student teachers, in Northern Ireland, and is located within the context of "STEM" (Science, Technology, Engineering and Mathematics). Based on the results of an attitudinal questionnaire and focus group interviews, it has been concluded that there must be corporate responsibility for the teaching and delivery of Mathematics. Those involved in teaching Mathematics, whether directly or indirectly through a different subject area, must not only be knowledgeable in subject content and its associated pedagogy, but ideally convey a positive attitude towards Mathematics. Ritzhaupt, Higgins and Allred (2011) investigated the effects of modern educational game playing on Middle School students' attitudes towards Mathematics, Mathematics Self-efficacy, and Mathematics Achievement. ANCOVA detected significant and positive changes in students' attitudes towards mathematics and mathematics self-efficacy. Reed, Drijvers and Kirschner (2010) investigated the effects of student attitudes and behaviours on the outcomes of learning mathematics with computer tools. Detailed observation of a small number of students revealed positive attitudes towards mathematics and mathematical computer tools augmented exhibited learning behaviours, and that both a positive attitude to mathematical computer tools and exhibited learning behaviours benefited tool mastery. Although tool mastery and test scores are intimately related, reflective processes appear to mediate this relationship. Promoting learning with mathematical computer tools needs to take several factors into account, including improving student attitudes, raising levels of learning behaviours, and giving sufficient opportunity for constructing new mathematical knowledge within meaningful mathematical discourse. Barkatsas, Kasimatis and Gialamas (2009) aimed to investigate the complex relationship between students' mathematics confidence, confidence with technology, attitude to learning mathematics with technology, affective engagement and behavioural engagement, achievement, gender and year level. It was found that, boys expressed more positive views towards mathematics and more positive views towards the use of technology in mathematics, compared to girls. It was also found that, high achievement in mathematics was associated with high levels of mathematics confidence, strongly positive levels of affective engagement and behavioural engagement, high confidence in using technology and a strongly positive attitude to learning mathematics with technology. Low levels of mathematics achievement was associated with low levels of mathematics confidence, strongly negative levels of affective engagement and behavioural engagement, low confidence in using technology, and a negative attitude to learning mathematics with technology. Ifamuyiwa and Akinsola (2008) investigated the effects of self and cooperative-instructional strategies on Senior Secondary School students' attitude towards Mathematics. Findings showed that the treatments had significant main effect on students' attitude towards Mathematics. The participants exposed to self-instructional strategy had the highest post-test mean attitude score. The study found no significant main effects of locus of control and gender on the participants' attitude towards mathematics.

Objectives of the Study

1. To find out the significant difference in the pre-test scores between the control and experimental groups with regard to attitude towards mathematics.
2. To find out the significant difference in the post-test scores between the control and experimental groups with regard to attitude towards mathematics.
3. To find out the significant difference between the pre-test and post-test scores of the control group with regard to the attitude towards mathematics.
4. To find out the difference between the pre-test and post-test scores of the experimental group with regard to the attitude towards mathematics.

Hypotheses

H_1: There is no significant difference in the pre-test scores

between the control and experimental groups with regard to attitude towards mathematics.

H_2: There is no significant difference in the post-test scores between the control and experimental groups with regard to attitude towards mathematics.

H_2: There is no significant difference between the pre-test and post-test scores of the control group with regard to the attitude towards mathematics.

H_4: There is no significant difference between the pretest and post-test scores of the experimental group with regard to the attitude towards mathematics.

Method of Study

Experimental method was adopted in the present study to find out the effectiveness of interactive multimedia learning package.

Design of the Study

Research Design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure (Kothari, 2007, p.31). In this study, pre-test and post-test equivalent group design was used.

The study was carried out in following stages.

Stage - I: Grouping the Sample

At this stage, the learners were tested on intelligence, and the quarterly marks in mathematics. On the basis of that, the students were divided into two groups such as control group and experiment group. The scores in the mentioned tests proved the homogeneity of the sample groups.

Stage - II: Conducting Pre-test

At this stage, both the control and the experimental groups underwent pre-test with the tool Attitude towards mathematics.

Stage - III: Conducting the Treatment

At this stage, both the control and the experimental groups were given the treatments. The experimental treatment, i.e. teaching with the interactive multimedia learning package (developed by the investigator) was given to the experimental group and the conventional teaching method was given to the control group.

Stage - IV: Conducting Post-test and Retention Test

At this stage, both the control and the experimental groups underwent post-test and hence, learners were tested on attitude towards mathematics in the specified content when the treatment period was over.

Stage - V: The Results of the Treatment

The effectiveness of the multimedia learning package was found out by the post-test scores.

Sample

In the present study, the sample consisted of 42 High School Students. Control and experimental group consists of 21 students. The students were divided by using the quarterly marks in Mathematics and the intelligence test. For intelligence test, the investigators used the non-verbal intelligence test developed and standardized by Atmananda Sharma (2005).

Establishing Homogeneity

Establishment of homogeneity of both the groups can be revealed from the following Tables 1 and 2.

Tool used

To measure the level of intelligence of the sample students, Non-verbal intelligence test which was of Dr. Atmananda Sharma (2005) and Attitude towards Mathematics (ATMa, 2013) developed by the investigators were used for the present study.

Validity

For establishing the content validity, the tool was given to two experienced psychologist; two experienced teacher educators of mathematics for validation; and two language experts, one from the Department of English and one from the Department of Tamil for language correction.

Group	Size	Mean	S.D.	t – value	P–value
Control	21	31.81	11.99	0.00	1.00^{NS}
Experimental	21	31.81	12.32		

NS – Not Significant at 5 % level

Table 1. Significance Difference in the Quarterly Marks in Mathematics between the Sample Groups

Group	Size	Mean	S.D.	t – value	P - value
Control	21	19.43	4.52	0.00	1.00^{NS}
Experimental	21	19.43	5.00		

NS – Not Significant at 5 % level

Table 2. Significance Difference in the Intelligence Test Scores between the Sample Groups

The item analysis were also made.

Reliability

The reliability of coefficient of the tool ATMa using the Spearman Prophecy formula was found to be 0.89.

Statistical Techniques Used

The data obtained were statistically analyzed by calculating arithmetic mean, standard deviation and t-test.

Analysis of Data

H_1: There is no significant difference in the pretest scores between the control and experimental groups with regard to the attitude towards mathematics.

It is inferred from the Table 3 that, the calculated t-value (0.056) is less than table value (0.5197) for df (20) at 5% level of significance. Hence, the null hypothesis is accepted. It shows that, there is no significant difference in the pretest scores between the control and experimental groups with regard to the attitude towards mathematics.

H_2: There is no significant difference in the posttest scores between the control and experimental groups with regard to the attitude towards mathematics.

It is inferred from Table 4 that, the calculated t-value (3.381) is greater than table value (0.5197) for df (20) at 5% level of significance. Hence, the null hypothesis is rejected. It shows that, there is a significant difference in the post-test scores between the control and experimental groups with regard to the attitude towards mathematics. It was found that, the post-test scores of the experimental group were significantly higher than those of the control group with regard to attitude towards mathematics. It may be due to the fact that, the interactive multimedia learning package is more effective than the traditional method of teaching.

H_3: There is no significant difference between the pretest and post-test scores of the control group with regard to the attitude towards mathematics.

It is inferred from the Table 5 that, the calculated t-value (0.083) is less than table value (0.5197) for df (20) at 5% level of significance. Hence, the null hypothesis is accepted. It shows that, there is no significant difference between the pre-test and post-test scores of the control group with regard to the attitude towards mathematics.

H_4: There is no significant difference between the pretest and post-test scores of the experimental group with regard to the attitude towards mathematics.

It is inferred from Table 6 that, the calculated t-value (7.762) is greater than table value (0.5197) for df (20) at 5% level of significance. Hence, the null hypothesis is rejected. It shows that, there is no significant difference between the pretest and post-test scores of the experimental group with regard to the attitude towards mathematics. It was found that, the post-test scores of both the control and experimental groups were significantly higher than the pretest scores with regard to attitude towards mathematics. It may be due to the fact that, the interactive multimedia learning package is more effective than the traditional method of teaching.

Educational Implications

The findings of the study clearly showed that, teaching through the interactive multimedia learning package develops students' attitude towards mathematics. Hence

Group	Size	Mean	S.D	t value	P value
Control	21	189.62	25.02	0.056	0.956^{NS}
Experimental	21	189.19	29.38		

NS – Not Significant at 5% level

Table 3. Difference in the Pre-test Scores between the Control and Experimental Groups with Regard to Attitude Towards Mathematics

Group	Size	Mean	S.D	t value	P value
Control	21	189.86	17.02	3.381	0.003^{S}
Experimental	21	210.62	26.89		

S – Significant at 5% level

Table 4. Difference in the Post-test Scores between the Control and Experimental Groups with Regard to Attitude Towards Mathematics

Group	Size	Mean	S.D	t value	P value
Pre -test	21	189.62	25.015	0.083	0.935^{NS}
Post -test	21	189.86	17.021		

NS – Not Significant at 5% level

Table 5. Difference Between the Pre-test and Post-test Scores of the Control Group with Regard to the Attitude Towards Mathematics

Group	Size	Mean	S.D	t value	P value
Pre -test	21	189.19	29.378	7.762	$.000^{S}$
Post -test	21	210.62	26.886		

S- Significant at 5% level

Table 6. Difference Between the Pre-test and Post-test Scores of the Experimental Group with Regard to the Attitude Towards Mathematics

the study recommended to the curriculum framers that learning through the interactive multimedia learning packages may be included as a method of teaching and learning at high school levels.

The school administration must be aware of the present scenario of Education which is highly associated with Techno-pedagogical practices. Hence, the School management must understand the importance of interactive multimedia learning package and provide sufficient chance to the teachers to use the same at their classroom.

Since the students of the experimental group who were taught through the interactive multimedia learning package performed better than the control group students who were taught through traditional teaching method. It is recommended that, for the students while teaching, the concept will be supplement with interactive multimedia components. Therefore, the traditional method of teaching mathematics can be integrated by the interactive multimedia learning package to improve attitude towards mathematics.

Students' attitude towards a subject determines their success in that subject. In other words, favorable attitude result to good achievement in a subject. Since the students of the experimental group who were taught through the interactive multimedia learning package were scored higher than the control group students who were taught through traditional teaching method with regard to attitude towards mathematics. This interactive multimedia learning package is recommendable to the teachers to develop the attitude towards Mathematics among High School students.

Conclusion

New technologies will force us to shift from teaching to learning. Computers and Multimedia instruction have significantly changed the face of Education and have greatly enhanced the learning process. Advancement in instructional delivery, technology has direct impact on attitude towards mathematics and hence teaching and learning process. Multimedia has great potential and plays a vital role in Education. The conventional teaching methods are not sufficient to arouse interest in Mathematics among the students and do not meet up to Intellectual, Psychological and Emotional needs of the students. The methods of teaching mathematics need to be changed. The modern teaching concept holds the view, that it is more learner centered and learner driven. Education has been undergoing a slow evolution; from teacher centered system to a learner-centered system, and this demands changes in the instructional process and materials used for making the process more effective.

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