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Teacher-assisted multimedia instructional package – An assured Modusto augment science learning interest of secondary school students

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Abstract
Multimedia bridges the gap between the teaching and learning processes in the Physics classroom by the fruitful realisation of the curricular objectives. The study purported to develop a Teacher-Assisted Multimedia Instructional Package in Physics and to test its effectiveness in augmenting Science Learning Interest of Secondary School Students of Kerala. Further, this effectiveness was to be compared with that of the Activity Oriented Method of Instruction. The Quasi Experimental Method with the Pre-Test Post-Test Non Equivalent Groups Design was found to be suitable for the study. The Teacher-Assisted Multimedia Instructional Package and the Activity Oriented Method of Instruction were the independent variables while Science Learning Interest was the dependent variable of the study. The experiment was conducted on a sample of 400 Secondary School Students of Kerala with 200 each in the Experimental and Control Groups. The results of the study showed that the Teacher-Assisted Multimedia Instructional Package in Physics is more effective than the Activity Oriented Method of Instruction in augmenting Science Learning Interest of the Students. The study yielded similar findings with regard to the Gender Groups of Students, viz. Boys as well as Girls.

Keywords: Multimedia, science learning interest, instructional package

1. Introduction

1.1 Background of the Study

Education is simply a Process characterized as an interaction between the teacher and the Student for the purpose of understanding, identifying and confirming the worthwhile knowledge. It is more than teaching and learning with an emphasis on technology. Science is an inseparable part of modern life. It is viewed by common man as a body of scientific information. Science gives opportunity for creative thinking and constructive imagination. The conventional teaching methods do not meet up to the intellectual, psychological and emotional needs of the students and are insufficient to actively involve students in studying Science. The methods of teaching need a drastic change and it should be more student-centered. Modern instructional strategies provide divergent thinking that facilitates improved learning and longer retention. Technology continues to move forward and it provides the possibility of instant exchanges of information between classrooms as well as individual students. Multimedia is becoming an important part of any classroom. The challenge for educators is to determine the appropriateness of multimedia use and ensure its success in the classroom. In the classroom, Multimedia should be used as a tool rather than as a novelty. Multimedia has an undisputed place but certainly will not replace good teaching. Schools are perhaps the best places for tapping the potentials of multimedia. Many educators perceive multimedia as a panacea to all educational woes. Lots of new technologies are emerging in the field of teaching Physics, with ongoing research in teaching Physics using Multimedia. The role of Multimedia is also evident in the documentation of Physics practices. Most of the teachers practice traditional methods for teaching Physics. Since the classrooms are crowded, the teachers are unable to capture the attention of the students. Consequently, the percentage of marks and percentage of passes in a year, with regard to Physics, is obviously poor. Interactive Multimedia is an answer to this situation.

Physics is a subject that gives meaning to nature and natural phenomena. It is essential that students be taught in the natural set up.

Though the traditional method of teaching helps to some extent, Multimedia is capable of motivating students towards self-achievement. For example, when the concept of Universe is to be taught, Multimedia animation comes in helpful. When the concept of frictional force is explained, graphics and animation are useful in driving home the idea of natural phenomena in a clear cut way. In magnetism, it is not known in which direction the magnetic attraction and repulsion is made, but this could be clearly conveyed using Multimedia.

2. Need & Significance of the Study

Revolution in all spheres of education is at the threshold of the new millennium. Multimedia has been touted as the preferred medium in revolutionizing education. It is a popular technology that serves as a communication facilitator and also serves as an instructional delivery medium. It plays an important role in enhancing the learning abilities of the students. The conception of the Multimedia as a learning environment is instantiated in varied forms, from online versions of traditional computer assisted instruction to innovative individual and group virtual – learning modes. Teacher-Assisted Multimedia Instruction is a powerful interaction medium that enables students to communicate with peers, teachers, and experts and conduct collaborative work (Mioduser, 2000) [9]. Teacher-Assisted Classroom Instruction is a method in which the teacher will contact the suitable web site and collect more and recent information related to a topic and use it for classroom teaching. Abstract ideas can be explained easily with 3D pictures, animation and Multimedia.

Many studies have concluded that Multimedia can improve the quality of achievement in many areas. Multimedia Package can bring significant difference in achievement of Biological Science (Anboucarassy, 2010) [2]. Most of the Multimedia programmes for educational purpose create situations such that Students can interpret information for their own understanding (Kumar and Hebtemariam, 2010) [8]. Experimental evidence by Priya (2012) [11], Abbas (2011) [1] and Baby (2013) [3] support the notion that Multimedia Instructional Packages are associated with performance to improve the Science Learning Interest. Multimedia based instruction is effective for improving achievement in Science among problem Students (Reddy, Ramar and Ponnambalam, 2009) [12]. These results point to the fact that Multimedia has high significance and immense prospects in shaping the Science Learning Interest of students in the field of Science education. Science Learning Interest is the interest for Science and allied areas of work. It may also defined as a positive feeling attached to the abstract and concrete aspects of scientific creativity, which manifests in the form of acceptance for and a satisfaction in all activities and movement connected with science.

Proper development of Instructional Package in Physics can be ensured by making students feel that Multimedia is an important object of instruction. This can be done only by means of an effective method of Instruction. A Multimedia Instructional Package is bound to have profound influence on the Science Learning Interest of students. Further, it could foster and motivate the students towards learning the subject.

The Investigators, both having long innings in the field of Teaching, felt that Secondary School Students have very little Science Learning Interest. Several researchers have developed various instructional strategies in Physics for Secondary School Students, but none was found that could augment Science Learning Interest. So it was decided to develop a Teacher-Assisted Multimedia Instructional Package to augment Science Learning Interest of Secondary School Students. In the present study, a Teacher-Assisted Multimedia Instructional Package in Physics for Secondary School Students was developed and its effectiveness tested in augmenting the Science Learning Interest of Secondary School Students of Kerala.

3. Hypothesis of the Study

It was hypothesised that the Teacher-Assisted Multimedia Instructional Package will be significantly more effective than the Activity Oriented Method of Instruction in augmenting Science Learning Interest of Secondary School Students for the Total sample as well as for their Gender Sub Samples.

4. Objective of the Study

The objective of the study was to compare the effectiveness of the Teacher-Assisted Multimedia Instructional Package and that of the Activity Oriented Method of Instruction in augmenting Science Learning Interest among Secondary School Students for the Total sample as well as for their Gender Sub Samples.

5. Methodology in Brief

The Quasi Experimental Method with the Pre-Test Post-Test Non Equivalent Groups Design was adopted for the present study. The Teacher-Assisted Multimedia Instructional Package and the Activity Oriented Method of Instruction were the independent variables while Science Learning Interest was the dependent variable of the study. Experimental verification was imperative to determine the effectiveness of the Teacher-Assisted Multimedia Instructional Package over the Activity Oriented Method of Instruction on Science Learning Interest of Secondary School Students.

Random Sampling Technique was employed for gathering data giving due representation to Gender of students. The total sample comprised 400 Secondary School Students, with 200 each in the groups randomly assigned as the Experimental and Control Groups, from schools in Thrissur and Ernakulam Districts of Kerala.

The materials used for the experiment were:

1. Teacher-Assisted Multimedia Instructional Package (Jaise and Murali, 2011)
2. Lesson Plans based on Activity Oriented Method of Instruction (Jaise and Murali, 2011)

They were developed from three Units of the Physics Textbook of Standard VIII, viz. Magnetism, Static Electricity and Celestial Sights.

The tools used for the study were:

1. Evaluation Pro forma for Validating the Teacher-Assisted Multimedia Instructional Package (Jaise and Murali, 2011)
2. Science Learning Interest Inventory (Suresh and Joseph, 1996) [13]

The Evaluation Pro forma was used for Validating the Teacher-Assisted Multimedia Instructional Package. The Science Learning Interest Inventory was initially administered to the Experimental and Control Groups in

order to assess the Science Learning Interest of Secondary School Students. The scores obtained thus were taken as the Pre-Test scores. The Experimental Group was exposed to the Teacher-Assisted Multimedia Instructional Package while the Control Group was exposed to the Activity Oriented Method of Instruction. After experimental treatment, the Science Learning Interest Inventory was again administered on both Experimental and Control Groups. The scores obtained thus were considered as Post-Test scores.

The data gathered was then analysed using statistical techniques like Arithmetic Mean, Standard Deviation, Critical Ratio (Test of Significant Difference between Means), and Tests of Variance, viz. Analysis of Variance (ANOVA) as well as Analysis of Covariance (ANCOVA).

6. Findings and Discussions of Results

A comparison was made of the effectiveness of the Teacher-Assisted Multimedia Instructional Package and the Activity Oriented Method of Instruction on the Science Learning Interest of Secondary School Students for the Total Sample as well as for both the Gender Groups.

The Pre-Test, Post-Test and Gain scores in Science Learning Interest of the Total Sample as well as of both the Gender Sub Samples in the Experimental and Control Groups were computed and the data are given in Table 1.

Table 1: Data for Pre-Test, Post-Test and Gain scores in Science Learning Interest of Total Sample and of Gender Sub Samples in Experimental and Control Groups

Samples	Groups		N	Pre-Test Scores			Post-Test Scores			Gain Scores		
				M	SD	t value	M	SD	t value	M	SD	t value
Total Sample	Experimental		200	8.23	1.73	0.71	18.72	13.11	6.91	10.49	13.19	6.95
	Control		200	8.36	1.93		12.21	2.43		3.85	2.94	
Gender Sub Samples	Boys	Experimental	98	8.26	1.64	1.30	17.44	2.79	13.79	9.18	2.84	13.11
		Control	87	8.63	2.16		12.29	2.29		3.65	2.89	
	Girls	Experimental	102	8.20	1.82	0.76	19.94	18.11	4.53	11.74	18.22	4.38
		Control	113	8.02	1.67		12.14	2.55		4.12	3.03	

From Table D, for df 198(Total), df 183(Boys) and df 213(Girls), $t_{0.01}$=2.59

Table 1 shows that the obtained 't' values with regard to the Pre-Test Scores in Science Learning Interest of the Total Sample, of the Boys, as well as of the Girls are 0.71, 1.30 and 0.76 respectively, which are not significant. From these results, it can be inferred that there is no significant difference between the Pre-Test scores of the Total Sample, of the Boys, as well as of the Girls in the Experimental and Control Groups before the Experiment. Since the Means and Standard Deviations of the Experimental and Control Groups are almost similar in value, it can be concluded that the Total Sample as well as both the Gender Sub Samples of Secondary School Students are almost identical with regard to their Pre-Test scores in Science Learning Interest.

Table 1 also shows that the obtained 't' values with regard to the Post-Test Scores in Science Learning Interest of the Total Sample, of the Boys, as well as of the Girls are6.91, 13.79 and 4.53 respectively, which are significant at 0.01 level. From these results, it can be inferred that there is significant difference between the Mean Post-Test scores of the Total Sample, of the Boys, as well as of the Girls in the Experimental and Control Groups after the Experiment. Since the Mean Post-Test scores of the Experimental Group (18.72, 17.44 and 19.94) are greater than those of the Control Group (12.21, 12.29 and 12.14) for the Total Sample, for the Boys, and for the Girls respectively, it can be concluded that the Teacher-Assisted Multimedia Instructional Package is superior to the Activity Oriented Method of Instruction for the Total Sample as well as for their Gender Sub Samples.

From Table 1, the obtained 't' values with regard to the Gain Scores of the Total Sample, of the Boys, as well as of the Girls are 6.95, 13.11 and 4.38 respectively, which are significant at 0.01 level. From these results, it can be inferred that there is significant difference between the Mean Gain scores of the Total Sample, of the Boys, as well as of the Girls in the Experimental and Control Groups. Since the Mean Gain scores of the Experimental Group (10.49, 9.18 and 11.74) are greater than those of the Control Group (3.85, 3.65 and 4.12) for the Total Sample, for the Boys, and for the Girls respectively, it can be concluded that the Teacher-Assisted Multimedia Instructional Package is superior to the Activity Oriented Method of Instruction for the Total Sample as well as for their Gender Sub Samples.

The Tests of Variance were used to ascertain the genuineness of the difference in the obtained Scores. The Total Sum of Squares, Mean Square Variance and F-ratio for the Pre- and Post-Test scores of Experimental and Control Groups were computed for the Total Sample as well as for both the Gender Sub Samples and the details of Analysis of Variance are shown in Table 2.

Table 2: Summary of ANOVA of Pre-Test (x) and Post-Test (y) Scores in Science Learning Interest of Total Sample and of Gender Sub Samples in Experimental and Control Groups

Samples		Source of Variation	df	SS_X	SS_Y	MS_x	MS_Y	F_X	F_Y
Total Sample		Among Means	1	1.69	4238.01	1.69	4238.01	0.50	47.66
		Within Groups	398	1341.50	35387.35	3.37	88.91		
		Total	399	1343.19	39625.36				
Gender Sub Samples	Boys	Among Means	1	6.55	1223.00	6.55	1223.00	1.79	184.67
		Within Groups	183	666.85	1211.95	3.64	6.62		
		Total	184	673.40	2434.95				
	Girls	Among Means	1	1.89	3261.24	1.89	3261.24	0.62	20.51
		Within Groups	213	648.64	33861.38	3.05	158.97		
		Total	214	650.54	37122.62				

Result: F_X values are not significant
F_Y values are significant at 0.01 level

From Table F, for df 398 (Total), $F_{0.05}$ = 3.86 and $F_{0.01}$ = 6.70

From Table F, for df 184 (Boys) and 213 (Girls), $F_{0.05}$ = 3.89 and $F_{0.01}$ = 6.76

Table 2shows that the obtained F_X values are 0.50, 1.79 and 0.62 for the Total Sample, for the Boys, and for the Girls respectively, all of which are less than the Table values and hence are not significant. This indicates that there is no significant difference between Pre-Test scores of the Total Sample, of the Boys and of the Girls, in the Experimental and Control Groups. The obtained F_Y values are 47.66, 184.67 and 20.51 for the Total Sample, for the Boys and for the Girls respectively, all of which are greater than the Table values and are significant at 0.01 level. The significant F_Y values indicate that the Experimental and the Control Groups differ significantly in the Post-Test scores of Science Learning Interest.

The Total Sum of Squares and Adjusted Mean Square Variance for Post-Test scores of Science Learning Interest for the Total Sample as well as for the Boys and the Girls are computed and the results of Analysis of Covariance are presented in Table 3.

Table 3: Summary of ANCOVA of Pre-Test (x) and Post-Test (y) Scores in Science Learning Interest of Total Sample and of Gender Sub Samples in Experimental and Control Groups

Samples		Source of Variation	df	SS_X	SS_Y	SS_{XY}	SS_{YX}	MS_{YX}	S D	$F_{Y\cdot X}$
Total Sample		Among Means	1	1.69	4238.01	-84.63	4256.57	4256.57	9.44	47.79
		Within Groups	397	1341.50	35387.35	189.35	35360.62	89.07		
		Total	398	1343.19	39625.36	104.72	39617.19			
Gender Sub Samples	Boys	Among Means	1	6.55	1223.00	-89.52	1261.94	1261.94	2.52	198.29
		Within Groups	182	666.85	1211.95	189.23	1158.25	6.36		
		Total	183	673.40	2434.95	99.70	2420.19			
	Girls	Among Means	1	1.89	3261.24	78.69	3256.09	3256.09	12.64	20.34
		Within Groups	213	648.64	33861.38	-18.05	33860.88	159.72		
		Total	214	650.53	37122.62	60.64	37116.97			
Result: All the F_{YX} values are significant at 0.01 level										

From Table F, for df 397(Total), $F_{0.01} = 6.70$; df 183(Boys), $F_{0.01} = 6.76$ and for df 212(Girls), $F_{0.01} = 6.72$

Table 3 shows that the obtained F_{YX} values for the Total Sample, for the Boys and for the Girls are 47.79, 198.29 and 20.34 respectively, all of which are greater than the Table values, and hence the differences between the two Groups are significant at 0.01 level for the Total Sample as well as for their Gender Sub Samples.

From the results of ANCOVA pertaining to Science Learning Interest of the Total Sample as well as of both the Gender Sub Samples, the significant F-ratios for the Adjusted Post-Test scores show that the scores of students in the Experimental Group and in the Control Group differ significantly after they have been Adjusted for Differences in the Pre-Test scores. The significant F-ratios necessitate that the differences be tested separately by the calculation of Adjusted Mean scores (t-test). The Adjusted Means for the Post-Test scores of Total Sample as well as of their Gender Sub Samples in the Experimental and Control Groups were computed and the data are given in Table 4.

Table 4: Data for Adjusted Means of Post-Test Scores in Science Learning Interest of Total Sample and of Gender Sub Samples in Experimental and Control Groups

Samples		Groups	N	M_X	M_Y	Adjusted Mean	't' value	P
Total Sample		Experimental	200	8.23	18.71	18.72	6.95	$P<0.01$
		Control	200	8.36	12.20	12.19		
Gender Sub Samples	Boys	Experimental	98	8.25	17.44	17.49	14.22	$P<0.01$
		Control	87	8.63	12.28	12.23		
	Girls	Experimental	102	8.20	19.94	19.94	4.56	$P<0.01$
		Control	113	8.02	12.14	12.14		
Result: All the 't' values are significant at 0.01 level								

From Table D, for df 397(Total), $t_{0.01} = 2.59$. df 182(Boys), $t_{0.01} = 2.60$ and df 212(Girls), $t_{0.01} = 2.59$

From Table 4, it can be seen that the 't' values obtained are 6.95, 14.22 and 4.56 respectively for the Total Sample as well as for the Boys and for the Girls, all of which are significant at 0.01 level. The results of Adjusted Means pertaining to Science Learning Interest for the Total Sample as well as for the Boys and the Girls in the Experimental Groups (18.72, 17.49 and 19.94 respectively) are greater than those of the Control Groups (12.19, 12.23 and 12.14 respectively). This points to the fact that students in the Experimental Group are superior to those in the Control Group with regard to Science Learning Interest for the Total Sample as well as for both the Gender Sub Samples. It may therefore be inferred that the students who were exposed to the Teacher-Assisted Multimedia Instructional Package have augmented their Science Learning Interest as compared to those who were exposed to the Activity Oriented Method of Instruction. In other words, the Teacher-Assisted Multimedia Instructional Package is more effective than the Activity Oriented Method of Instruction in augmenting Science Learning Interest among Secondary School Students for the Total Sample as well as for both the Gender Sub Samples.

7. Conclusion

The above results show that there is significant difference in Science Learning Interest with regard to the Total Sample as well as both the Gender Sub Samples of Secondary School Students in the Experimental Group. Those students who were exposed to the Teacher-Assisted Multimedia Instructional Package show higher Science Learning Interest as compared to those who were exposed to the Activity Oriented Method of Instruction. Such findings could only be

attributed to the Teacher-Assisted Multimedia Instructional Package that must have motivated and helped the students to augment their Science Learning Interest. Furthermore, the findings of this study are supported by researches of Baby (2013) [3], Priya (2012) [11], and Christidou (2011) [5]. Thus, the study concludes that the Teacher-Assisted Multimedia Instructional Package is very effective in augmenting Science Learning Interest among Secondary School Students.

8. Educational Implications of the Study

The findings of the study have certain educational implications that are outlined below:

- Facilities must be provided in educational institutions to organise Multimedia classes. Digital content that is meaningful, culturally responsive and has high quality must be made available for use of both teachers and students.
- Multimedia Instructional Packages will help to turn Teacher-centred lessons into Student-centred ones. So adequate guidance must be provided to Teacher educators to equip them in the development of different types of Packages, which they can employ in their classrooms for effective teaching. Such a shift in focus is likely to bring about a vast change in the Science Learning Interest of students.
- Instructional Packages based on Multimedia need to be developed so as to help Students to develop higher mental as well as intellectual skills. Such Instructional Packages will help students to be aware of the changes in education arising from technological advances which in turn will go a long way in positively influencing their Science Learning Interest.
- Multimedia classes will provide teachers with a platform for sharing subject matter and the scope of the feedback.
- The Teacher-Assisted Multimedia Instructional Package provides a successful platform to convey concepts effectively and help the students to augment their Science Learning Interest. This Package also helps to actively participate in the learning process.
- The Teacher-Assisted Multimedia Instructional Package augments the Science Learning Interest of the Students thereby inculcating the values of Science.
- Innovative Multimedia based instructional strategies and materials should be provided among Secondary School teachers. They should be encouraged to use Multimedia in their teaching.
- In service and refresher courses should be organized for Secondary School teachers in order to familiarize them with the new trends and patterns of Multimedia with a view to draw out more involvement of students in studies.

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