IOSR Journal of Humanities And Social Science (IOSR-JHSS)
Volume 26, Issue 1, Series 5 (January. 2021) 19-24
e-ISSN: 2279-0837, p-ISSN: 2279-0845.
www.iosrjournals.org

Efficacy of Web Assisted Multimedia Package to Enhance the Basic Process Skill of Inference in Physics

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Abstract: The study purported to develop a Web Assisted Multimedia Package in Physics and to test its effectiveness in enhancing The Basic Process Skill of Inference in Physics 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 Web Assisted Multimedia Package and the Activity Oriented Method of Instruction were the independent variables while the Basic Process Skill of Inference in Physics 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 Web Assisted Multimedia Package in Physics is more effective than the Activity Oriented Method of Instruction in enhancing the Basic Process Skill of Inference in Physics of the Students.

Background*:* Multimedia has been touted as the preferred medium in revolutionizing education. 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.

Materials and Methods*:* IThe Quasi Experimental Method with the Pre-Test Post-Test Non Equivalent Groups Design was adopted for the present study. The Web Assisted Multimedia Package and the Activity Oriented Method of Instruction were the independent variables while The Basic Process Skill of Inference in Physics was the dependent variable of the study. Experimental verification was imperative to determine the effectiveness of the Web Assisted Multimedia Package over the Activity Oriented Method of Instruction on the Basic Process Skill of Inference in Physics 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.

Results*:* The Web Assisted Multimedia Package is more effective than the Activity Oriented Method of Instruction in enhancing The Basic Process Skill of Inference in Physics among Secondary School Students for the Total Sample.

Conclusion:There is significant difference in the Basic Process Skill of Inference in Physics with regard to the Total Sample of Secondary School Students in the Experimental Group. Those students who were exposed to the Web Assisted Multimedia Package show higher The Basic Process Skill of Inference in Physics as compared to those who were exposed to the Activity Oriented Method of Instruction.

Key Word*:*Multimedia, Basic Process Skill, Inference, Instructional Package

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Date of Submission: 04-01-2021 Date of Acceptance: 19-01-2021

I. INTRODUCTION

Education today is more than teaching and learning with an emphasis on technology. Learning using technologies has become a global phenomenon. Science is an inseparable part of modern life and is viewed by common man as a body of scientific information. 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 radical change and it should be more student-centered. Modern instructional strategies provide divergent thinking that facilitates better learning and longer retention.

Multimedia holds greater promise in enhancing learning as well as in improving the quality of education. It 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 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

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 oscillation is to be taught, Multimedia animation comes in handy. When the concept of Universe is explained, graphics and animation are useful in driving home the idea of natural phenomena in a clear cut way. In electricity, it is not known in which direction the current flows, but this could be clearly conveyed using Multimedia.

Every piece of ongoing research needs to be connected with the work already done so as to attain an overall relevance and purpose. Erkol and Ugulu (2014)determined the Biology teacher's level of Scientific Process Skills. Remziye, Yeter, Calis, Ozdilek, Sirin and Meral (2011) found that use of Inquiry based teaching methods significantly enhances students' Science Process Skills and attitudes. Strawitz (2006) examined the effects of testing on Science Process Skill achievement of students using self-instructional materials. Baby (2014) elaborated the use, utility and importance of Computer Assisted Instructional Package in Organic Chemistry teaching and it implies that the application of Integrated Modern technologies in the teaching–learning process is very effective in our classroom. Chitra (2014) introduced a Multimedia Instructional Package in Solid Geometry to test its effectiveness in enhancing Conceptual Clarity, Problem Solving Ability, Achievement as well as Retention in Solid Geometry at Secondary School level by comparing its relative effectiveness with Activity Oriented Method of Instruction. Gupta and Tyagi (2014) tested the effectiveness of computer-assisted instruction on achievement in Biology among Senior Secondary School students.

These review of related literature helped to gather extensive information on Process Skills in Physics and Multimedia Instructional Packages. Multimedia can enhance and strengthen the impact of activities in the Science class room. It can visually demonstrate scientific ideas and concepts. Multimedia can facilitate the development of Science Process Skillsof students, necessary for students to engage in authentic scientific inquiry **(**Roth and Roychoudhury, 2006**)**.

Teaching and learning of Science needs to be characterised by focused emphasis on various The Basic Process Skill of Inference in Physics (Science - A Process Approach SAPA, 1967). These The Basic Process Skill of Inference in Physics can be acquired by actively participating in the learning process. The major factors that influence Science teacher's preference for different types of instructional activities have been identified. The most important factor that has an impact on Science teachers is to motivate students to develop Science Process Skills (Talanquer, Novodvorsky and Tomanek, 2010**)**. The crucial part in the development of Science Process Skills among students is the preparation of Multimedia Instructional Packages in tune with the content of the syllabus. The Multimedia Instructional Package subsumes the idea that the Basic Process Skills once developed can be transferred to other content areas. Therefore, there is a need to develop such Multimedia Instructional Package for promoting and enhancing these The Basic Process Skill of Inference in Physics. Science is a part of our life. A Student must be able to apply the content of Science, by learning how to do the process aspect of Science. Hence, there is a need to revisit our Science teaching and change focus from the product aspect to the process aspect of Science learning.

There are several advantages to implementing Multimedia in the classroom**.** It motivates the student to learn. Multimedia crafts interesting lessons. Multimedia allows teachers to address various learning styles in the classroom - Students can see, hear, and imagine what things feel since Multimedia brings a subject to life. Besides, technology standards are also addressed. Students must be ready to compete in a highly technological world. Student-centered learning takes place and students show accountability for learning when collaborative activities or project based learning is implemented through technology. Thus, it provides occasion for differentiated instruction. Having different ways to present information to students allows teachers to meet the needs of all students.

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). Multimedia based instruction is effective for improving achievement in Science among problem Students (Reddy, Ramar and Ponnambalam, 2009). Multimedia Instructional Package can bring significant difference in achievement of Physics **(**Yang and Heh, 2007**)**.

These results point to the fact that Multimedia has high significance and immense prospects in enhancing The Basic Process Skill of Inference in Physics of students in the field of science education. 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 Basic Process Skill of Inference in Physics of students. Further, it could foster and motivate the students towards learning the subject.
In the present study, a Web Assisted Multimedia Package in Physics for Secondary School Students was developed and its effectiveness tested in enhancing the Basic Process Skill of Inference in Physics of Secondary School Students of Kerala.

HYPOTHESIS OF THE STUDY
It was hypothesised that the Web Assisted Multimedia Package will be significantly more effective than the Activity Oriented Method of Instruction in enhancing the Basic Process Skill of Inference in Physics of Secondary School Students for the Total sample.

OBJECTIVE OF THE STUDY
The objective of the study was to compare the effectiveness of the Web Assisted Multimedia Package and that of the Activity Oriented Method of Instruction in enhancing the Basic Process Skill of Inference in Physics of Secondary School Students for the Total sample.

II. MATERIALS AND METHODS

The Quasi Experimental Method with the Pre-Test Post-Test Non Equivalent Groups Design was adopted for the present study. The Web Assisted Multimedia Package and the Activity Oriented Method of Instruction were the independent variables while The Basic Process Skill of Inference in Physics was the dependent variable of the study. Experimental verification was imperative to determine the effectiveness of the Web Assisted Multimedia Package over the Activity Oriented Method of Instruction on the Basic Process Skill of Inference in Physics 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. Web Assisted Multimedia 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 Web Assisted Multimedia Package (Jaise and Murali, 2011)
2. Comprehensive Test of Basic Process Skills in Physics (Jaise and Murali, 2011)

The Comprehensive Test of Process Skills in Physics was initially administered to the Experimental and Control Groups in order to assess the Basic Process Skill of Inference in Physics of Secondary School Students. The scores obtained were taken as the Pre-Test scores. The Experimental Group was exposed to the Web Assisted Multimedia Package while the Control Group was exposed to the Activity Oriented Method of Instruction. After experimental treatment, the Comprehensive Test of Process Skills in Physics 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).

III. FINDINGS AND DISCUSSIONS OF RESULTS

A comparison was made of the effectiveness of the Web Assisted Multimedia Package and the Activity Oriented Method of Instruction on the Basic Process Skill of Inference in Physics 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 The Basic Process Skill of Inference in Physics 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 The Basic Process Skill of Inference in Physics of Total Sample in Experimental(N=200) and Control (N=200) Groups

The Basic Process Skill	Group	Pre-Test Scores			Post-Test Scores			Gain Scores		
		M	SD	't' value	M	SD	't' value	M	SD	't' value
Inference	Experimental	1.29	0.59	1.36	2.41	0.51	13.82	1.15	0.69	11.03
	Control	1.20	0.42		1.64	0.60		0.44	0.59	

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

FromTable 1,it can be seen that the obtained 't' values are 1.36 for the the Basic Process Skill of Inference in Physics, which is not significant. From these results, it can be inferred that there is no significant difference between the Pre-Test scores of the Total Sample 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 of Secondary School Students are almost identical with regard to their Pre-Test scores in the Basic Process Skill of Inference in Physics.

Table 1 also shows thatthe obtained 't' values are 13.82 for the Basic Process Skill of Inference in Physics, which is 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 in the Experimental and Control Groups after the Experiment. Since the Mean Post-Test scores of the Experimental Group (2.41) is greater than those of the Control Group (1.64) for the Total Sample, it can be concluded that the Web Assisted Multimedia Package is superior to the Activity Oriented Method of Instruction for the Total Sample.

From Table 1, the obtained 't' values with regard to the Gain Scores of the Total Sample are 11.03 for the Basic Process Skill of Inference in Physics which is 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 in the Experimental and Control Groups. Since the Mean Gain scores of the Experimental Group 1.15) is greater than those of the Control Group (0.44) for the Total Sample, it can be concluded that the Web Assisted Multimedia Package is superior to the Activity Oriented Method of Instruction for the Total Sample. 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 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 The Basic Process Skill of Inference in Physics of Total Sample in Experimental and Control Groups

The Basic Process Skill	Source of Variation	df	SS_X	SS_Y	MS_X	MS_Y	F_X	F_Y
Inference	Among Means	1	0.56	60.06	0.56	60.06	2.14	191.65
	Within Groups	398	104.82	124.74	0.26	0.31		
	Total	399	105.38	184.80				
Result:	F_X value is not significant F_Y value is significant at 0.01 level							

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

Table 2 shows that the obtained F_X values is 2.14for the Basic Process Skill of Inference in Physics, which is less than the Table values and hence is not significant. This indicates that there is no significant difference between Pre-Test scores of Secondary School Students in the Experimental and Control Groups. The obtained F_Y value is 191.65 for the Basic Process Skill of Inference in Physics, which is greater than the Table values and hence is significant at 0.01 level.

The significant F_Y value indicates that the Experimental and the Control Groups differ significantly in the Post-Test scores of the Basic Process Skill of Inference in Physics. The significant F_Y value indicate that the Experimental and the Control Groups differ significantly in the Post-Test scores of the Basic Process Skill of Inference in Physics.

The Total Sum of Squares and Adjusted Mean Square Variance for Post-Test scores of the Basic Process Skill of Inference in Physics for the Total Sample 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 The Basic Process Skill of Inference in Physics of Total Sample in Experimental and Control Groups

The Basic Process Skill	Source of Variation	df	SS_X	SS_Y	SS_{XY}	SS_{YX}	MS_{YX}	SD_{YX}	F_{YX}
Inference	Among Means	1	0.56	60.06	5.81	56.04	56.04	0.54	195.77
	Within Groups	397	104.82	124.74	34.10	113.64	0.29		
	Total	398	105.38	184.80	39.91	169.68			
Result:	All the F_{YX} values are significant at 0.01 level								

From Table F, for df 397(Total), $F_{0.01} = 6.70$

Table 3 shows that the obtained F_{YX} value for the Total Sample is 195.77 for the Basic Process Skill of Inference in Physics, which is greater than the Table values, and hence the differences between the two Groups are significant at 0.01 level for the Total Sample.

From the results of ANCOVA pertaining to the Basic Process Skill of Inference in Physics of the Total Sample, 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 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 the Basic Process Skill of Inference in Physics of Total Sample in Experimental and Control Groups

The Basic Process Skill	Groups	N	M_X	M_Y	M_{XY} (Adjusted)	SE_D	't' Value	P
Inference	Experimental	200	1.27	2.41	2.40	0.054	13.89	P < 0.01
	Control	200	1.20	1.64	1.65			
	General Means		1.24	2.03				
Result:	All the 't' values are significant at 0.01 level							

From Table D, for df 397(Total), $t_{0.01} = 2.59$.

From Table 4, it can be seen that the 't' value obtained is 13.89 for the Basic Process Skill of Inference in Physics, which is significant at 0.01 level. This indicates that the two Adjusted Means differ considerably and implies that the Experimental and Control Groups differ significantly in the Basic Process Skill of Inference in Physics.

The results of Adjusted Means pertaining to The Basic Process Skill of Inference in Physics for the Total Sample in the Experimental Groups (2.40) is greater than those of the Control Groups (1.65). This points to the fact that students in the Experimental Group are superior to those in the Control Group with regard to The Basic Process Skill of Inference in Physics for the Total Sample. It may therefore be inferred that the students who were exposed to the Web Assisted Multimedia Package have enhanced their The Basic Process Skill of Inference in Physics as compared to those who were exposed to the Activity Oriented Method of Instruction. In other words, the Web Assisted Multimedia Package is more effective than the Activity Oriented Method of Instruction in enhancing The Basic Process Skill of Inference in Physics among Secondary School Students for the Total Sample.

IV. CONCLUSION

The above results show that there is significant difference in the Basic Process Skill of Inference in Physics with regard to the Total Sample of Secondary School Students in the Experimental Group. Those students who were exposed to the Web Assisted Multimedia Package show higher The Basic Process Skill of

Inference in Physics as compared to those who were exposed to the Activity Oriented Method of Instruction. Such findings could only be attributed to the Web Assisted Multimedia Package that must have motivated and helped the students to enhance their The Basic Process Skill of Inference in Physics.

V. EDUCATIONAL IMPLICATIONS OF THE STUDY

The findings of the study have certain educational implications. Instructional Packages based on Multimedia 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 The Basic Process Skill of Inference in Physics. Multimedia Instructional Packages will help to turn Teacher-centred lessons into Student-centred ones. Such a shift in focus is likely to bring about a vast change in the Basic Process Skill of Inference in Physics of students. Multimedia presentations in the classroom will go a long way to tackle classroom management issues. Multimedia classes will provide teachers with a platform for sharing the subject matter as well as the scope of the feedback. The Web Assisted Multimedia Package provides a successful platform to convey concepts effectively and help the students to enhance their The Basic Process Skill of Inference in Physics. This Package also helps to actively participate in the learning process. 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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