The Relationship between Simulation Assisted Instruction and Attitude towards Physics of Adolescent Students

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Abstract

In this study, the effect of simulation assisted instruction on attitude towards physics of adolescent students is explored. For this, the achievement scores in Physics of adolescent students who were taught using simulation assisted instruction and others who followed traditional lecture method were correlated separately using Pearson 'r' with the scores obtained by administering the physics attitude scale. The findings indicated that there is a positive significant correlation exists between the achievements in Physics of adolescent students exposed to simulation assisted instruction in their attitude towards Physics. This implies that the teachers may integrate simulation assisted instruction in their class room teaching so that their students enhance their positive attitude toward physics. As a result of this increase, students could have better accomplishments in the field of physics.

Keywords: Simulated assisted instruction; attitude towards Physics; adolescent students.

1. Introduction

In the past few decades, use of animations and technologies were used increasingly in the teaching learning process of the science subjects. Integrating simulations as part of the science curriculum makes easier understanding of the theories and concepts in Physics.

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The use of simulations in the teaching learning process provides students with not only visual experience, but rather a way to imbibe the concept through interaction in their own convenient timings. Simulations provide a virtual laboratory like situations in learning science concepts.

This is particularly helpful in learning Physics concepts as students consider Physics as one of the toughest science subjects. Moreover, for solving problems in Physics, both mathematical and conceptual skills are required. The use of simulations gives more interactive experience in the form of visual, experimental and sound. This is more effective than DVDs as the chances of virtual experimentation is absent in use of DVDs.

Simulations act as a versatile medium in conveying the complex Physics concepts in a simple manner and the limitations of traditional classrooms are replaced by motivating individual or group activities. Enriched teaching and learning experience is possible in Physics by incorporating simulations in instructional design and using them as a part of the curricular design. The chances to repeat the simulation reinforce easy understanding. Thus, simulation assisted instruction in Physics enhances students' enthusiasm and reasoning abilities and encourage them to learn more complex concepts in Physics. Independent learning of Physics concepts helps learners to build new concepts and they become self-paced, self-directed and innovative learners.

1.1. Research Hypotheses

The hypotheses formulated and tested at the 0.05 level of significance were as follows:

- Ho1: There is no significant relationship between the attitude towards Physics of adolescent Students who were taught through simulation assisted instruction and traditional lecture/activity method.
- Ho 2: There is no significant difference between the attitude towards Physics of male students and their female counterparts when taught through a simulation assisted instruction.

2. Review of Literature

Many studies show that there is significant effect of interactive lecture experiments on students' academic achievement and attitudes towards physics. Computer-based Interactive Lecture Experiments (ILEs) for a large introductory physics course showed significant relationship between students' academic achievement and attitude towards physics [1]. The effects of instructor lead and self-directed quandary-solving tactics on students' attitude toward Physics were discussed in another study [2].Similarly, the effects of the computer-simulated experiment (CSE) and the problem-solving approach on students' chemistry achievement, science process skills, and attitudes toward chemistry at the high school level were analyzed in another study [3]. Likewise, the study on the Effect of Computer Assisted Instruction with Simulation in Science and Physics Activities on the Success of Student: Electric Current observes the effect of computer assisted instruction (CAI) with a simulation technique used in teaching the subject of "Electric Current" on the successes of students [4]. The study 'Seamless Connection between Learning and Assessment- Applying Progressive Media assisted learning in science education' showed that developing a series of worksheets as scaffolding to support inquiry-based ecology observations in a mobile learning environment were effective in improving the field observation performance of the students[5].

3. Materials and Method

3.1. Research Design

The study adopted a mixed method which involved an experiment as well as a survey.

3.2. Sample and Sampling Technique

The participants for this study were 1100 adolescent students studying in different schools in Calicut district, Kerala, India. The selection was based on purposive sampling technique which involved 5 schools each from different parts of the area which had computer facility and which do not have computer facility. The teachers of five schools which had computer facility were given training in Simulations on topics related to ohms law, electrical circuits, electromagnetic induction, magnetism and reflection and refraction of light. The Simulations selected for use in the class room were adopted from PhET simulations and the EJSS simulations related to each topic in Physics. The topics were selected in such a way that it covered the syllabi for instruction in the chosen group for one full semester. An objective test was prepared for assessing the effect of simulation assisted instruction. The students from the remaining five schools were taught by their respective teachers in the traditional lecture/activity method. The same objective test was used to measure their achievement also.

Student's Attitude to Physics Scale (Sandhya, 2000) was used by researcher and was validated through experts 'review of the items. The draft scale was prepared with 60 statements. Almost equal number of positive and negative statements was included. The suggestions and comments of colleagues in related disciplines who read through the instrument were taken into consideration in removing or adding some items to the instruments. The final draft was then administered to 370 students in a school who were not part of the sample. This was used to compute reliability coefficient of the Students' Attitude to Physics Scale using Spearman Brown Prophecy formula in which 0.87 was obtained. The validity of the scale using correlation method was found to be 0.865.

4. Data collection and analysis

The size of the sample proposed for the study was 1100 which was a representative of the population. Out of this 550 students were from the traditional learning environment without Physics simulation. The remaining 550 students were taken from institutions where Physics was taught with computer simulations. With the help of teachers in the respective schools, the tool was administered after the completion of the specific topics for both groups. But due to absenteeism of students in some of the selected schools, a total of 1074 answer scripts were collected back. After the rejection of defective and incomplete answer scripts evaluation of answer scripts for each tool were done based on the answer key. This caused a further reduction of sample size to 860 taking 430 samples each from the traditional learning environment without Physics simulation and remaining 430 from Physics learning with computer simulations. Data collected were analyzed using correlation and t-test. Multiple Classification was used to explain the Attitude of the different categories of students.

5. Results and discussion

Ho1: There is no significant relationship between the attitude towards Physics of adolescent Students who were

taught through simulation assisted instruction and traditional lecture/activity method.

This part of the analysis was used to examine the extent of correlation between simulations assisted instruction and attitude towards Physics for adolescent students and to test whether the correlations of the two groups differ significantly. The details of the 'r' obtained for simulated assisted instruction and attitude towards Physics for the whole sample and the subsamples are given in Table-1.1.

Table 1.1: Details of correlation coefficient obtained for total sample and sub samples

No.	Sample	#Type of sample	Sample size	Correlation coefficient 'r'	Confidence interval of 0.01 level		% of overlap
					Lower limit	Upper limit	
1	Total	LCS	430	0.344*	0.234	0.454	11.83
		TL	430	0.228	0.107	0.342	5.19

\# LCS- learning with computer simulation; TL-Traditional learning;

* Significant at 0.01 level (0.234 < r-value < 0.454).

5.12. Correlation analysis for subgroups

- Ho 2: There is no significant difference between the attitude of male students and their female counterparts in Physics when taught through simulation assisted instruction. This part of analysis was used to examine, the extent of correlation between simulations assisted instruction and attitude towards Physics for male and female students and to test whether the correlations of the group differ significantly. The details of the 'r' obtained for simulated assisted instruction and attitude towards Physics for the sub samples is given in the Table-1.2.

Table 1.2: The Details of the 'r' obtained for simulated assisted instruction and attitude towards Physics for the sub samples

No.	Sample	#Type of sample	Sample size	Correlation coefficient 'r'	Confidence interval of 0.01 level		% of over lap
					Lower limit	Upper limit	
1.	Girls	LCS	285	0.324*	0.186	0.461	10.49
		TL	285	0.215	0.065	0.355	4.62
2.	Boys	LCS	145	0.403*	0.229	0.583	16.24
		TL	285	0.310	0.104	0.490	9.61

\# LCS-learning with computer simulation, TL-Traditional learning.

* Significant at 0.01 level (0.229 < r-value < 0.583 for Boys & 0.186 < r value < 0.461 for Girls)

For the boys in the group learning with computer simulation, the correlation 'r' obtained for the simulation assisted instruction and attitude towards Physics is 0.403. This indicates that the relationship between them is moderate. The correlation coefficient is positive. This indicates that a positive relationship prevail between simulation assisted instruction and attitude towards Physics. The significance of the correlation ('t' value calculation for "r") is 5.265 which is larger than the tabled value of 't' at 0.01 level (2.58). This indicates that 'r' is significant at 0.01 level. The confidence interval at 0.01 level is 0.229 to 0.583. The shared variance of variables is 16.24 which indicates that 16.24 % attitude towards Physics is attributed by simulation assisted instruction. Significant, positive and moderate correlation exists between simulation assisted instruction and Attitude towards Physics for boys.

For Girls, for the group learning with computer simulation, the correlation 'r' obtained for the simulation assisted instruction and attitude towards Physics is 0.324. This indicates that the relationship between them is low. The correlation coefficient is positive. This indicates the existence of a positive relationship between simulated assisted instruction and attitude towards Physics. The significance of the correlation ('t' value calculation for "r") is 5.761 which is larger than the tabled value of 't' at 0.01 level (2.58). This indicates that 'r' is significant at 0.01 level. The confidence interval at 0.01 level is 0.186 to 0.461 and percentage overlap of variables is 10.497. From this it is evident that 10.497 % of attitude towards Physics is attributed by simulation assisted instruction. Significant, and positive but low correlation exists between simulation assisted instruction and Attitude towards Physics for girls.

5.13. Comparison of equivalent correlations obtained for subgroups

The equivalent correlations obtained for the relationship between the simulations assisted instruction and attitude towards Physics based on gender was compared for the difference in 'r's. The obtained correlation is subjected to errors of sampling as it is reasonable to expect that the difference between correlations may be due to sampling errors. The details are provided in Table 1.3.

Table 1.3: Comparison of the equivalent correlations obtained for boys and girls

#Type of sample	Sample size		Correlation coefficient		Critical ratio
	Boys N_1	Girls N_2	Boys r_1	Girls r_2	CR
LCS	145	285	0.403	0.324	0.783
TL	145	285	0.310	0.215	0.923

LCS-learning with computer simulation, TL-Traditional learning

The obtained critical ratio for the group who learned Physics concepts with computer simulations reveals that significant difference does not exist between the groups –boys and girls. For values 0.783 is less than 2.58. This means that the two groups are similar with respect to simulation assisted instruction. This is the same in the case of the traditional learning group. Therefore gender difference does not exist in the relationship between simulation assisted instruction and attitude towards Physics.

6. Conclusion and Recommendations

In line with the findings of this study, it was found that instructional procedures have significant influence on the attitude of adolescent students towards Physics. This can be seen irrespective of gender difference. Based on this the following recommendations can be put forward: Further investigation can be conducted to study the effect of various learning methods on attitude towards Physics. It is also possible to conduct this study by classifying the groups based on their achievement level and their association with variables, instructional procedures and attitude towards Physics.

Further this study can be conducted in other groups and strata. This study can be further extended to different strata of the schools like schools in rural and urban and government and public sectors. Further, this study can be taken to identify and rectify the drawbacks in the existing instructional techniques which hampers the attitude of students towards Physics.

7. Educational Implications

The traditional method of instruction hampers the positive attitude towards Physics, which in turn hinders the progress of students in that subject area. It has been proved beyond doubt that the simulation assisted instruction influences positively the attitude towards Physics. This study can be used by teachers to modify his/her mode of instruction so as to meet the individual needs of children. The teacher can develop a techno-pedagogic competency and implement new modes of transaction so as to generate in students a right attitude towards Physics. They can innovate new ideas for making class interesting by including various novel techniques of teaching, including simulations. Interaction with well-designed simulations helps students to develop mental models. They question, correct and redesign mental pictures related to complex Physics concepts. This helps them to restructure their own knowledge domain and the knowledge of their students as well. The parameters of learning they set should be high adapting modern technologies. The traditional demotivating study habits should be changed to self- paced independent learning which challenges their own potential. Simulated assisted instruction significantly influences the attitude of adolescent children towards Physic. Therefore this model can be used by teachers to modify the mode of instruction so as to meet the individual needs of students.

References

[1] Rahel F.Moll, Marina Miller-Bolotin.(2009).The Effect of Interactive Lecture Experiments on Student academic achievement and Attitudes towards Physics. "Canadian Journal of Physics." 87(8) 917-924 10.1139/ p09 -048.

[2] Naki Erademir (2009). "Determining students' attitude towards physics through problem solving strategy". Asia-Pacific Forum on Science Learning and Teaching," Volume 10, Issue 2, Article 1.

[3] Geban, O. (1992). "Effects of Computer Simulations and Problem-Solving Approaches on High School Students". *Journal of Educational Research, 86*(1), 5-10.

[4]   Mustafa BAKAÇ1,Aslıhan KARTAL TAŞOĞLUI and Turgay AKBAY2(2009).''The Effect of Computer Assisted Instruction with Simulation in Science and Physics Activities on the Success of Student: Electric Current''. Eurasian Journal of Physics and Chemistry Education, 34-42, 2011.

[5]   Hung, P.-H., Hwang, G.-J., Lin, Y.-F., Wu, T.-H., & Su, I.-H. (2013). "Seamless Connection between Learning and Assessment -Applying Progressive Learning Tasks in Mobile Ecology Inquiry". Educational Technology & Society, 16 (1), 194–205.

[6]   Bogner,F.X., Rubitzko,T., Schall,S., (Girwidz, 2006) "Media-assisted Learning in Science Education: An interdisplinary Approach to Hibernation and Energy transfer". Science Education International Vol 17, No.2, pp-95-107.