

Students' performance using Physics Education Technology (PhET) Interactive Simulation strategy

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Abstract

Physics Education Technology (PhET) interactive simulation is a strategy that the students do engage in scientist like exploration and that this results in greater and deeper learning of scientific concepts through questioning, making connections, and deducing the rules. The study sought to find out the performance of students exposed using Physics Education Technology (PhET) interactive simulation strategy. Specifically, it aimed to find out the significant difference between the pretest and posttest scores of the students exposed using PhET interactive simulation strategy and lecture method, find out the significant relationship between the student's socio-demographic profile and the attitude towards PhET interactive simulation strategy, find out the significant relationship between the socio-demographic profile and the posttest score of the students exposed using PhET interactive simulation strategy and find out the significant relationship between the attitude towards PhET interactive simulation and the posttest score of students exposed using PhET interactive simulation strategy. There were eighty-eight (88) grade 8 students involved in the study. The study used the true experimental pretest-posttest control group design. Data were analyzed using percentage, mean, paired t-test, spearman rank correlation, and chi-square Paired t-test result showed a significant difference between the pretest and posttest scores of the students exposed using PhET interactive simulation strategy and lecture method. This study concluded that Physics Education Technology (PhET) interactive simulation strategy can improve the performance of the students.

Keywords: Physics Education Technology (PhET) interactive simulation strategy, performance, experimental group, control group, lecture method

1. Introduction

The students view physics to be cumulative because one gets lost if he/ she misses an idea (Brickhouse and Carter, 1989). Difficulty in delivering Science concepts and applications are lack of training of teachers and lack of advanced laboratory materials and equipment in the workplace also worsen the poor condition of teaching-learning process and the insufficient resources of teaching tools, techniques, and strategies in Science hinder to achieve the desired skills and competencies (Linog, 2013). Activity-based approaches altogether improve students' critical thinking and scientific attitudes (Akporehwe and Onwioduokit, 2010). Interactive simulations are a better approach to exchange logical thoughts and connects students in instructive activities (Perkins, et al., 2006; Linn, et al., 2004). Other factors that dramatically affect a student's academic performance is their socio-demographic profile which includes sex, educational attainment of the parents, the income level of the household, whether or not there are both parents in the home and the number of siblings within a household (National Institute for Literacy, 2001). The Texas State Board of Instruction (1994) states that boys more often than not perform way better in math than young ladies which young ladies ordinarily studied superior than boys. These are some factors that contributed to increasing the least learned competencies in Physics and eventually affect the student's performance in the National Achievement tests. Recent studies of PhET interactive simulation uncover that the use of analogy encourages students' development of their understanding; whereas the nature of direction impacts the sum of student engagement (Adams, 2006). He added that PhET Interactive simulations students do engage in scientist like exploration and that this results in greater and deeper learning of scientific concepts. Taking the time to explore the simulation via their questioning, making connections, and deducing the rules. Getting students to engage productively with activity and exhibit scientist-like behavior requires both balanced challenges and eliciting the correct mode of engagement.

II. Methodology

The participants of the study were the eighty- eight (88) grade 8 students of Molugan National High School, Molugan, El Salvador City, Misamis Oriental, Philippines. The study used the true experimental research design, the randomized pretest-posttest control group design. Two (2) groups were involved in the study wherein the forty- four (44) students were exposed to Physics Education Technology (PhET) interactive simulation strategy and the forty- four (44) for the Lecture Method respectively. The performance of the students was measured through pretest and posttest. The pretest and posttest questionnaires were composed of fifty (50) items multiple choices.

III. Results and Discussion

Table 1 shows the paired t-test result showing the difference between the pretest and posttest scores of the two groups. Result reveals a significant difference between the pretest and posttest scores in Physics of the two groups as shown in their t-values of -18.07 and -17.67 and p-values of .000 and .000 respectively that leads to the rejection of the null hypothesis. It reveals a significant improvement in the scores of the students exposed using Physics Education Technology (PhET) interactive simulation strategy and lecture method. Both the two groups increased their performances in the posttests but better posttest scores shown of the students exposed using PhET interactive simulation strategy. It has been appeared that activity-based approaches altogether improve students' critical thinking and scientific attitudes (Akporehwe and Onwioduokit, 2010).

Table 1. Paired t-test result showing the difference between the pretest and posttest scores of the two groups

Group	Mean Score	Mean difference	t-value	p-value	Remarks
PhET interactive simulation strategy Pretest	26.95				
		-12.87	- 18.07	0.000	Significant
Posttest	39.82				
Lecture method Pretest	25.39				
		- 11.84	-17.67	0.000	Significant
Posttest	37.23				

With 0.05 level of significance

Table 2 displays the correlation test analysis result showing the relationship between the socio-demographic profile and the attitudes towards PhET interactive simulation strategy. Result shows a significant relationship between the students' attitude towards interactive simulation and socio-demographic profile in terms of the availability of computers at home as shown in their r- value of 21.930 and p-value of .000 that leads to the rejection of the null hypothesis. Frarlie (2009) believes that students with a computer at home perform better than those who did not have computers. Availability of computers at home can help improve the performance of the students when using PhET interactive simulation strategy. Socio-demographic profile in terms of sex, educational attainment of father, educational attainment of mother, parents' average monthly income reveals no significant relationship with the student's attitude towards PhET interactive simulation strategy as shown in their p-values of .070, .517, .989, .677 that leads to the non-rejection of the null hypothesis. This means that the students' demographic profile such as sex, educational attainment of father, educational attainment of mother, parents' average monthly income can't affect their attitude towards PhET interactive simulation strategy. It indicates that simulation applications have more positive effects on students' attitudes towards Science lessons compared to traditional instructions (Sari, et al., 2016).

Table 2. Correlation test analysis result showing the relationship between the students' socio-demographic profile and the attitudes towards PhET interactive simulation strategy

Variable	r- value	p-value	Remarks
Attitudes towards interactive simulation and socio-demographic profile Sex (Point Biserial Correlation)	-.276	.070	Not Significant
Educational Attainment of Father (Spearman Correlation)	-.100	.517	Not Significant
Educational Attainment of Mother (Spearman Correlation)	.002	.989	Not Significant
Parents' Average Monthly Income (Spearman Correlation)	.065	.677	Not Significant
Availability of Computers at Home (Chi- Square)	65.476	.001	Significant

With 0.05 level of significance

Table 3 shows Correlation test analysis result showing the relationship between the socio-demographic profile and students' posttest score. It displays no significant relationship between the socio-demographic profile and posttest scores of the students exposed using PhET interactive simulation strategy as shown in their p-values of .351, .708, .580, and .829 respectively that leads to the non-rejection of the null hypothesis. The socio-demographic profile and students' posttest score show no significant relationship. This means that the students' socio-demographic profile can't affect their posttest score when exposed using PhET interactive simulation strategy. It is contrary to the idea of Henderson (1988) that children whose guardians are included in their student's formal instruction have way better grades, test scores, and, long-term academic achievement than do children with uninvolved mothers and fathers. He added that when parents serve as tutors for their children, their children's IQs increase significantly.

Table 3. Correlation test analysis result showing the relationship between the socio-demographic profile and students' posttest score

Variable	r- value	p-value	Remarks
Posttest score in PhET and Socio-demographic profile Sex (Point Biserial Correlation)	.144	.351	Not significant
Educational Attainment of Father (Spearman Correlation)	-.058	.708	Not significant
Educational Attainment of Mother (Spearman Correlation)	-.086	.580	Not significant
Parents' average monthly income (Spearman Correlation)	-.034	.829	Not significant
Availability of Computers at Home (Chi-square)	21.930	.969	Not significant

Table 4 reveals the Spearman rank correlation test analysis result showing the relationship between the students' attitude towards PhET interactive simulation strategy and students' posttest scores. It shows no significant relationship between the attitude towards Physics Education Technology (PhET) interactive simulation strategy and posttest scores of the students as shown in their r-value of -.186 of p-value of .226 that leads to the non-rejection of the null hypothesis. It reveals that attitudes towards PhET interactive simulation strategy can't affect the students' posttest score. Students' demeanors toward computers were fundamental issues in computer courses and computer-based instructive module (Woodrow, 1991). Checking the user's attitudes toward computers ought to be a persistent handle in case the computer is to be utilized as a instructing and learning device. Brosnan (1998) states that superior computer self-efficacy seem increment determination in considering computing

Table 4. Spearman rank correlation test analysis result showing the relationship between the attitude towards PhET interactive simulation strategy and students' posttest scores

Variable	r- value	p-value	Remarks
Attitudes towards PhET interactive simulation strategy and students' posttest score	-.186	.226	Not Significant

With 0.05 level of significance

IV. Conclusion

Based on the findings of the study, it revealed a significant difference between the pretest and posttest scores of the students exposed to Physics Education Technology (PhET) interactive simulation strategy and lecture method. This study concluded that Physics Education Technology (PhET) interactive simulation strategy can improve the performance in Physics of the students.

V. Recommendations

Based on the findings and conclusion of the study, the researchers would like to recommend that Physics Education Technology (PhET) interactive simulation strategy can improve the performance in Physics of the students. Similar study should be conducted using Physics Education Technology (PhET) interactive simulation strategy. In grouping the students, scores in the pretest should be considered. This strategy should also be conducted to other schools with different grade levels and in other disciplines too.

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