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EFFICACY OF COMPUTERIZD MOLECULAR MODEL IN ENHANCING SCIENCE PROCESS SKILLS OF SECONDARY LEVEL STUDENTS

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Abstract

The study of science is always innovative and interest. The science is meant for an inquiry which creates speculation among the students at every segment of the learning. The study of science is complex also because of its internationalism and innovations. Thus, science study has its own simplicity and complexity. There are many factors involve in reducing such complexity. The technology is one among them. The computerized molecular modeling (CMM) is one of the technological strategies of learning chemistry which is widely utilizing. The present study aims to verify the efficacy of CMM in enhancing students' Science process skills in chemistry to prove its consistency and permanency in learning. Based on the above features, it is observed that the CMM will play a pivotal role in enhancing the science process skills of the secondary level students in general and process skills of chemistry in particular. Hence, an endeavour has been taken to prove efficacy of CMM in bringing up the performance of the secondary level students in science through science process skills. The science process skills are the tools for both the groups of the present study. 80 Students from IX standard were chosen as sample by using simple random sampling technique. They were further fission in to 40 each in the control and experimental group. Since the score of the science process skills is more in the experimental group than control group, it is inferred that they were able to enhance the science process skills through CMM. The computerised molecular model had a good efficacy in improving students' science process skills irrespective of their confounding variables. Therefore, this present investigation concludes the CMM can be used as an instructional and learning strategy to the various tiers of students".

Introduction

The study of science is always innovative and interest. The science is meant for an inquiry which creates speculation among the students at every segment of the learning. The study of science is complex also because of its internationalism and innovations. Thus, science study has its own simplicity and complexity. There are many factors involve in reducing such complexity. The technology is one among them. The

computerized molecular modeling (CMM) is one of the technological strategies of learning chemistry which is widely utilizing. The present study aims to verify the efficacy of CMM in enhancing students' Science process skills in chemistry to prove its consistency and permanency in learning.

Molecular Modeling

Molecular Modeling is concerned with the description of the atomic and molecular interactions that govern *microscopic* and *macroscopic* behaviors of physical systems. The high-speed digital computer has, as in so many other aspects of modern life, changed the way we do and visualize organic chemistry. The ability to predict the outcome, in a quantitative sense, of a chemical reaction and to visualize organic molecules in three dimensions was, until fairly recently, the province of the specialist. Calculations that once taxed the largest computer facilities at a university can now be carried out on a desktop computer. This computational approach to chemistry is being used extensively in drug design, protein mutagenesis, biomimetic, catalysis, studies of DNA/protein interactions, and the determination of structures of molecules using NMR spectroscopy, to name just a few applications. Based on the above features, it is observed that the CMM will play a pivotal role in enhancing the science process skills of the secondary level students in general and process skills of chemistry in particular. Hence, an endeavour has been taken to prove its efficacy in bringing up the performance of the secondary level students in science through science process skills.

Objectives of the Study

The following objectives have been framed for the study:

1. To identify the efficacy of computerised molecular model in enhancing Science process skills of secondary level students. .
2. To identify the existing factors responsible for efficacy of computerized molecular modeling enhancing Science process skills of secondary level students. .

Hypotheses of the Study

The following hypotheses framed for the present study

1. There exists no significant difference between the Science process skills of the Experimental group students in the Pre Test and Post Test.
2. There exists no significant difference between the Science process skills of the Control group students in the Pre Test and Post Test.
3. There exists no significant difference between the Science process skills of the Control group and Experimental group students in Pre Test.
4. There exists no significant difference between the Science process skills of the Control group and Experimental group students in Post Test.

5. There exists no significant difference between the Pre Test and Post Test Science process skills of the Experimental group Male.
6. There exists no significant difference between the Pre Test and Post Test Science process skills of the Control group male.
7. There exists no significant difference between the Science process skills of the Control group and Experimental group male in the Pre Test.
8. There exists no significant difference between the Science process skills of the Control group and Experimental group male in the Post Test .
9. There exists no significant difference between the Pre Test and Post Test Science process skills of Experimental group Female.
10. There exists no significant difference between the Pre Test and Post Test Science process skills of the Control group female.
11. There exists no significant difference between the Science process skills of the Control group and Experimental group female in Post Test.
12. There exists no significant difference between the Science process skills of the Control group and Experimental group female in Pre Test.

Delimitations of the Study

1. The CMM was developed by the investigators himself with the help of local computer lab.
2. The chapter periodic classifications of elements and chemical bonds alone have taken for the experimentation.
3. The computerized molecular model efficacy was not established with more number of classes.

Review of Related Literature

Wilden, Antony.C (2008) conduct study on "Question Posing, Inquiry, and Modeling Skills of Chemistry Students in the Case-Based Computerized Laboratory Environment".

Lange, Dale (2008) conduct study on "The Effect of a Simulation on Middle School Students'Understanding of the Kinetic Molecular Theory".

Murray, Melissa Tenenbaum, Gerson (2010) conduct study on "Computerized Pedagogical Agents as an Educational Means for Developing Physical Self-Efficacy and Encouraging Activity in Youth".

Dori, Yehudit Judy, Kaberman, Zvia (2012) conduct study on "Assessing High School Chemistry Students' Modeling Sub-Skills in a Computerized Molecular Modeling Learning Environment".

Dori, Yehudit Judy, Kaberman, Zvia (2012) conduct study on "Assessing High School Chemistry Students' Modeling Sub-Skills in a Computerized Molecular Modeling Learning Environment".

Bennett, Stephanie J, Holmes, Joni, Buckley, Sue (2013) conduct study on "Computerized Memory Training Leads to Sustained Improvement in Visuospatial Short-Term Memory Skills in Children with Down Syndrome".

The review of related studies shows that in most of the studies on the efficacy of Computerised molecular modelling (CMM) of teaching on Science process skills the result is positive. But in few cases where comparison of Computerised molecular model with other strategies such as was conducted, the result is not highly significant. From that it is revealed that the efficacy on Science process skills is not conclusive. This led the investigators to go on with the present study.

Research Method and Design

With a view realizing the major objectives of the study, the investigators formulated a experimental design in which the experiment involves a comparison of the efficacy of Computerised molecular model of teaching. In order to study the higher Science process skills gain in chemistry through Computerised molecular Model over the experimental method the present study is conducted.

An experimental study of this type is normally conducted with respect to experimental and control group that are equated for related variables. Here the group in which the Computerised molecular model was introduced is the experimental group and the group in which the conventional method of teaching was introduced is the control group. The two groups were equated on the basis of pretest Science process skills scores.

The pretest post test equivalent groups design is one of the most effective designs in minimizing the threats to experimental validity. Hence, the investigators decided to select the above mentioned design. After conducting the experiment, the differences between the post test scores of both the groups were subjected to a statistical significance.

Variables of the Study

The independent variables of this study are the Computerised molecular Model of teaching. The Science process skills of chemistry among the IX standard students attained through CMM is treated as the dependent variable for the study. The gender was the confounding variable of the study.

Tools

There are two types of administrations conducted for the present study in which the first one is Traditional System of Teaching. The Second one is Computerised molecular Model Teaching. The science process skills are the tools for both the groups of the present study. The tools were prepared based on the skills to be assessed.

Validation of Research Tool

Reliability

The reliability of research tool was established by using the applying test-retest method. The pilot samplewas divided in two equivalent groups of students. They were given a first test and second test with the gap of the two week duration. The correlation co-efficient was found to be 0.76. and 0.72 for pre and post test tools respectively. The Co-efficient of correlation suggested that the Science process skills test possessed reliability to a high significant level.

Validity

The tools for the present study validated through expert validity. The items of the pretest and post test were shown to the three subject experts and are methodology expert. By went through the items, they modified and removed of the items and suggested some corrections. Based on such refinement, the tools of the both test validated and refined.

Sample of the Study

80 Students from IX standard were chosen as sample by using simple random sampling technique. They were further fission in to 40 each in the control and experimental group.

Delimitations of the Study

1. The CMM which was found in the web alone used for the intervention to the experimental group.
2. The chapters' periodic classifications of elements and chemical bonds alone have taken for the experimentation.
3. The computerized molecular model efficacy was not established with more number of classes.

Experimentation

In the present study, the investigators followed experimental method. The groups were equated on the basis of entry behaviour Science process skills scores in Chemistry. After obtaining the equated groups the actual process of experimentation began. One group comprising forty students who were taught by using Computerised molecular model was the experimental group and the other taught through conventional method was the control group. Each topic was taught by the Computerised molecular model and conventional method to the experimental and control group on the same day. The pretest was conducted at the beginning phase of the experimentation. Science process skills test was administered immediately after the experiment on the two groups. Science process skills in Chemistry of the two groups were subjected to a test of significance and two tailed test.

Table 1 The following Table (Table-1) Depicts the Mean, SD, and 't'-Value of the analyses Made on the Group and Test of the Present Research

Si. No.	Group	Test	N	M	SD	"r"	't' Value	LS
1	Pre	Experimental group	40	24.95	5.1	0.5	12.17	S
	Post		40	38.9	5.22			
2	Pre	Control group	40	23.4	6.56	0.81	1.911	NS
	Post		40	26.47	7.89			
3	Pre Test	Control group	40	23.4	6.56	-0.14	1.13	NS
		Experimental group	40	24.95	5.1			
4	Post test	Control Group	40	26.47	7.89	0.084	8.303	S
		Experimental Group	40	38.9	5.22			
5	Control Group male	Pre test	23	22.26	5.59	0.637	1.506	NS
		Post Test	23	24.73	5.71			
6	Pre test	Control Group	23	22.26	5.59	0.109	1.59	NS
		Experimental Group	23	24.95	5.9			
7	Post test	Control Group	23	24.73	5.71	0.0684	7.63	S
		Experimental Group	23	37.65	5.82			
8	Experimental Group Female	Pre test	17	24.94	3.78	0.14	12.31	S
		Post Test	17	40.58	3.66			
9	Control Group Female	Pre test	17	25.47	7.22	0.93	1.05	NS
		Post Test	17	28.52	9.88			
10	Post test	Control Group	17	28.52	9.88	-0.144	4.74	S
		Experimental Group	17	40.58	3.66			
11	Pre test	Control Group	17	25.47	7.22	0.011	0.339	NS
		Experimental Group	17	24.94	3.78			

S= Significant at 0.05 level

Major Findings

- Since the sample's Science process skills is more in the experimental group Test II, it is inferred that they were able to enhance the Science process skills through CMM.
- The computerised molecular model had a good efficacy in improving students Science process skills irrespective of their confounding variables.

Specific Findings

- There exists a significant difference between the Science process skills of the Experimental group students in the Pre Test and Post Test.
- There exists no significant difference between the Science process skills of the Control group students in the Pre Test and Post Test.
- There exists no significant difference between the Science process skills of the Control group and Experimental group students in Pre test.
- There exists a significant difference between the Science process skills of the Control group and Experimental group students in Post test.
- There exists a significant difference between the Pre Test and Post Test Science process skills of the Experimental group male.
- There exists no significant difference between the Pre Test and Post Test Science process skills of the Control group male.
- There exists no significant difference between the Science process skills of the Control group and Experimental group male in the Pre test.
- There exists a significant difference between the Science process skills of the Control group and Experimental group male in the Post test.
- There exists a significant difference between the Pre Test and Post Test Science process skills of Experimental group female.
- There exists no significant difference between the Pre Test and Post Test Science process skills of Control group female.
- There exists a significant difference between the Science process skills of the Control group and Experimental group female students in Post test.
- There exists no significant difference between the Science process skills of the Control group and Experimental group female students in Pre test.

Recommendations

- This method of teaching may be administered to the other subject student at degree level with the necessary modifications.
- The Computerised Molecular Model may be followed in different subject by alternating some norms and standards.
- The Computerised Molecular Model may be employed to appraise and develop the skill of the students and make them free from the rote memory.
- Once the above recommendations are followed, the Computerised Molecular Model will be more fruitful to the development of students as well as in the education pattern in India.

Suggestions for Further Research

1. This study may be conducted to the other subject of science such as physics, biology etc.

2. The study may be conducted to the other level such as master degree, post master degree, and even diploma levels.
3. The same study may be done with large number of sample with the different variables.
4. The study is conducted toward the selected 9th standard students. The same kind of study may be followed to develop the rest of the other level students.
   Thus, the investigation suggests the idea for the further investigations in the Selected field.

Conclusion

From the study and result arrived from the hypotheses testing the investigators concludes that the Computerised Molecular Model is helpful in enhancing Science process skills of the students and makes them free from the unnecessary feelings about the learning. He also concludes that this system of teaching is more economy and helpful in exploring more ideas of the student rather than the mere memory and reproducing the concepts. Hence the system may be followed in further to the other subject too, especially Physics and Biology for the betterment of the students. Therefore, this present investigation recommends the CMM to use as an instructional and learning strategy to the various levels of students".

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