Effectiveness of Virtual Laboratory Classes in promoting Chemistry Learning practices with reference to Achievement of pupils in Chemistry subject.

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ABSTRACT

The present study, **"**Effectiveness of Virtual Laboratory Classes in promoting Chemistry Learning practices with reference to Achievement of pupils in Chemistry subject. " aims to investigate the effectiveness of Virtual Laboratory Classes in improving the Achievement in Chemistry of secondary school pupils. The study is Experimental in nature. It was conducted on a total sample of 80 students of secondary school and the design of the study is per-test—post-test non-equivalent group design. Appropriate tools and statistical techniques were employed. The study revealed that the experimental group who received Virtual Laboratory Classes (VLC) showed improvement in Achievement.

Introduction

The 21st century is characterized by an influx of innovative technologies in diverse fields and so we find ourselves on the verge of a knowledge scenario that demands superior pedagogical practices and innovative use of technology. In this present digital era, the classroom can turn to be a wonder world of excitement for children with easy absorption of learning material through apt use of technology like internet, animations, PowerPoint presentations and so forth. The visualization of science education is used in its widest sense: from physical models to a variety of images, multimedia and interactive animations, and conveying virtual reality. All these visualization approaches, due to the rapid development of information-communication technology, have become an increasingly important tool of modern science lessons.

Educators have been seeking complements or substitutions for hands on laboratories for decades using new emergent and developed computer technologies .Therefore the use of virtual laboratory or simulation programs , overcomes some of the problems faced in traditional laboratory applications and make positive contributions in reaching the objectives of an educational system.

Laboratory activities for teaching practical skills are essentially a form of experiential learning (Abdulwahed & Nagy, 2009). In experiential learning students learn by actively interacting with their environment as opposed to theoretical classroom learning.Virtual Labs are essentially synthetic environments with attributes that include interactivity and real time feedback (Kozma, 2000). These attributes make Virtual Labs attractive for any teaching strategy. Practice for skills attainment involves interaction with equipment and work environment. Virtual Lab activities can be considered as a form of experiential learning as they allow students to their reinforcement or discover knowledge and skills through personal interaction. (Kolb, Boyatizs & Mainemelis, 2001).

Effectiveness of using virtual labs is dependent on the transfer of skills from the virtual lab to the real lab. And is dependent on the authenticity of the learning experience (Jonassen, 2000). Authenticity of learning is the extent to which interaction within the virtual environment is cognitively equivalent to interaction in a real environment. (Jonassen, 2000). The feedback from a virtual lab must be functionally equivalent to the real lab for authentic learning to occur. (Petraglia, 1998).

Virtual Labs have been suggested as a way to lighten the laboratory capacity problem by allowing students to practice critical thinking skills in a virtual environment when real physical equipment is unavailable. Virtual Laboratories have also been found useful in distance and computer assisted instruction in disciplines that require students to learn practical skills in addition to theoretical knowledge.

Virtual labs can free up physical laboratory space as the components of the physical lab are replaced by a server or a personal computer. Flexibility is achieved by the dissociation of the laboratory activity from schedules that logistically require students, teachers, and lab assistants to be in the same time and space. Students can perform laboratory assignments on their own schedule and from remote places.

Need and significance

This is an age of knowledge explosion where traditional method of verbal instruction will not help to keep pace with the development of knowledge. Educators teaching different subjects at different grade levels all over the world invariably encounter with some questions like " How to teach a lesson to a class that consists of students with different skills , learning pace, learning styles and cognitive styles?" and " How to make learning more effective ,interesting, exciting and less time consuming ?". A powerful technology integrated sensory learning environment, which can provide individualized instruction will help the learners to satisfy their academic needs at their own pace. As expected throughout the world the idea of using student centered constructivist based instructional methods is widely accepted ,since teacher centered traditional instructional methods has given insufficient opportunities for student to construct their own learning. Since, most of the contents of science lessons are abstract topics, to make students to understand such topics it is necessary to use constructivist based student centered instructional methods. In the

Chemistry laboratory students become active in their learning by seeing observing and doing. Many researchers in science education admitted that laboratory studies increase students interest and abilities for the science subjects (Bryant and Edmunt , 1987; Beaker , 1996; Algan 1999).

The most often cited benefit of Virtual laboratory is that it can be done at the student's convenience and when he/she learns best. The same is true of Virtual laboratories if the experiments are on the student's own time. In some cases, a virtual lab may be used during regular class time which narrows this benefit but still allows flexibility for the teacher who is not limited by using resources within a strict timeframe.

In the real world situation, sometimes due to the limitation of equipments, limited time allocated for the topic or insufficient laboratory conditions force teachers not to perform lab activities in crowded groups, or sometimes a demonstrational activity can be performed. This application is opposed to the basic constructivist philosophy at laboratory method which accepts that knowledge can be gained only through personal experience and observation. When looking these limitations into consideration looking for appropriate alternatives is inevitable. Among these alternatives, the use of educational technology more specifically the use of computer in supporting the laboratory methods can be a logical one. Educational practitioners believe that virtual reality technology has provided new insight to support education. Duffy and Jonnasen (1992) claimed that today‟s educational technology practices should indeed be couched in constructivist paradigm. Therefore as an experimental tool, virtual reality is an active knowledge creation environment. A technique that may minimize any limitations to learning caused by working memory space and abstract perceptions and thereby provide effective visualization strategies will be very useful for effective learning of Chemistry. Here comes the importance of Virtual Laboratory classes which is technologically driven. Virtual Lab concept was defined as "Laboratory experiment without real laboratory with its walls and doors" .It enables the learner to link between the theoretical aspect and practical one, without papers and pens. It is electronically programmed in computer in order to simulate the real experiments inside the real laboratories. It provides the students with tools, materials and lab sets on computer in order to perform experiments at anywhere at any time. These experiments are saved on CD‟s or on website. So the investigator feels the necessity to conduct an experimental study to find out the effectiveness of Virtual Laboratory Classes (VLC) in improving the Achievement of learning chemistry subject.

Objectives of the Study

1. To find out, whether there is significant difference exists between Virtual Laboratory Classes over the Conventional Activity oriented Method of Instruction in improving the Achievement in Chemistry of Pupils at secondary Level

Hypotheses

1. The Virtual Laboratory Classes is better than the Conventional Activity oriented Method of Instruction in improving the Achievement in Chemistry of Students at secondary Level

Methodology

The present study was focused on studying the effectiveness of VLC on academic achievement in Chemistry subject among Secondary school students of Kerala. The study was experimental in nature and adopted the pre-test post-test non-equivalent group design which consisted of an experimental group and a control group. The Experimental group was given an instruction using Virtual Laboratory Classes (VLC) and control group was taught using Conventional Activity Oriented method. Two groups were given equal attention during the course of experiment.

Sample

The population consisted of 80 students in standard IX of S.N.M.H.S.S in Ernakulum District of Kerala following state syllabus. Investigator decided to adopt simple random sampling technique for sample selection. Out of the selected two divisions of Standard IX from the school, one was taught (experimental group) using Virtual Laboratory Classes and the other was taught (control group) through the Conventional Activity Oriented Method by investigator.

Tools employed for the study

For the purpose of present study the investigator made use of the following materials and tools.

- Lesson Transcripts based on V L C
- Lesson Transcripts based on Conventional Activity Oriented Method
- Achievement Test in Chemistry

Statistical Techniques

The different statistical techniques employed are Analysis of Variance, Analysis of Covariance (ANCOVA) and Estimation of adjusted means.

Analysis and Discussion

The test scores were tabulated and analyzed and is given under the following tables.

The single factor ANOVA with pre- experimental status in achievement as covariate was employed to investigate the effectiveness of VLC in promoting academic achievement in Chemistry over Conventional Activity Oriented method .For this purpose , the sum squares , mean squares of variance along with the corresponding degrees of freedom and the F ratios were calculated for the total sample. The details are given in the Table 1

A) **Effectiveness of VLC over Conventional activity method for Total Sample of Students**

Table 1

Comparison of pre -test and post test scores (ANOVA Table) for Achievement in Chemistry for Total Sample

Source of variation	Df	SSx	SSy	MSx	MSy	Fx	Fy
Among means	1	0.61	28.8	0.61	28.8	0.73	13.66**
Within groups	78	65.78	164.4	0.84	2.11		
Total	79	66.39	193.2				

**: - Significant at 0.01 level *: - Significant at 0.05 level x : Pre test y : Post test

The analysis of variance of pre-test and post-test scores of pupils in experimental group showed in Table 1 that there is significant difference between the experimental group and the control group. (F_y =13.66, P<0.01).This shows the advantage of teaching through VLC. This data was again subjected to Analysis of Covariance.

Table 2

Comparison of post test scores after correcting for difference in pre test scores (ANCOVA) table for Achievement in Chemistry.

Source of variation	Df	SSx	SSy	SSy.x	MSy.x	SDy.x	Fy.x
Among	1	.61	28.8	4.2	27.21	1.45	12.88**
Within	77	65.78	164.4	10.6	162.69		
Total 79	66.39	193.2	14.8	189.9			

** : significant at 0.01 level x : Pre test y : Post test y.x : Adjusted post

Analysis of covariance of pretest and posttest scores of pupils in experimental and control group showed that there is significant difference between the two groups (F_{yx} =12.88, P<0.01). Table 2 implies that the experimental group excels control group in Achievement in Chemistry.

Table 3

Unadjusted and adjusted mean scores at pre and post test level of Achievement in Chemistry

	N	Mx	My	My.x	T
VLC method	40	1.16	4.2	4.19	0.40**
Activity Method	40	1	3	3.01	
Total	80				

** : significant at 0.01 level x : Pre test y : Post test y.x : Adjusted post

The T value for adjusted mean scores at pre and posttest level of Achievement in Chemistry (T=0.40, P<0.01) was found to be significant at 0.01 level. This reflects that the students of experimental group taught through VLC gained significantly higher scores than those taught through activity method. This confirms the supremacy of teaching through VLC over Activity method in improving the Achievement in Chemistry of Secondary School Students.

Educational implications

The findings of the study revealed that the Virtual Laboratory Class is effective than Prevailing Activity Oriented Method in learning Chemistry at Secondary level for the attainment of Achievement in Chemistry. The present study emphasizes the urgency of a vibrant instructional mechanism for up bringing the proficiency in Chemistry learning. The Chemistry VLC programs are adequate for promoting effective learning practices among pupils at Secondary school level. It was found out that while teaching, using strategies based on VLC, the interest of pupils was also increased. So the students should be handled with this method of instruction. The application of VLC will make the class interesting and lively. Teachers should be given proper training to use VLC, The effective use of materials and equipment of VLC is meaningless if teachers are unaware about them. The incorporation of such learning program should be emphasized in the teacher education curriculum and teacher educators should be equipped to translate the importance of learning program in their practice.

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