Research Article

Effectiveness of ICT Based Learning Material in Science Learning

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Abstract

In the present study researchers developed an ICT based learning material. It was a self-learning material, which was based on the principles of programmed learning. In the present study, an ICT based programmed learning material was developed on the topics "Matter in our surroundings" and "Is matter around us pure" based on the content of the NCERT Science textbook for class IX Students. The sample for the present study comprised of 180 students of class IX. A quasi-experimental research design was adopted for the study. This study involved the dependent variable as -Treatment Groups (Experimental Group Vs. Control Group) and an independent variable as- Achievement scores of students. An ICT based Programmed Learning Material, Pre, and Post achievement tests developed by the researchers were used. The data were analyzed by using the Mean, S.D., and Analysis of variance. Analysis of data revealed that teaching with an ICT based programmed learning material is more effective for the students as compared to the conventional method of teaching.

Keywords: ICT, Programmed Learning, Self-learning

Introduction

Information and Communication Technology (ICT) has made great progress towards the improvement of quality of education. Also to meet the increasing demands in the educational context of digital India, it is imperative to use technological devices in the teaching-learning process. The technological devices are expected to enhance the academic performance of students by the application of better techniques of educational technology in the system of education. The significant role of Technology in school education has been highlighted in the National Curriculum Framework 2005 (NCF, 2005). According to NCF-2005, there is an urgent need to convince the educational system, which should play an important role in engineering the teaching-learning situation and to make it a more meaningful experience for both teachers and their pupils. NCF -2005 also focuses that it is necessary to enable students to access sources of knowledge and interpret them, and to create knowledge rather than acting as passive users. At this level it is required to promote a flexible model of curriculum transaction, promote individual learning styles. In National Curriculum Framework focus group on educational technology emphasized that "Recognizes the potential of ICT and the Internet, promote universal

access, facilitate participatory forums, and develop communities and interest groups and enable students to access sources of knowledge and interpret them and to create knowledge rather than be passive users. To promote flexible models of curriculum transaction and also promote individual learning styles" (NCF, 2005). The use of ICT for personalized learning enables and empowers young people to pursue their knowledge. The applications of ICT make possible new and better ways of student learning (Kolderle & Mcdonald, 2009).ICT policy (2008) spotted a light on the role of ICT in Education. There are many advantages and constraints in the applications of ICT. The use of ICT aids in education has plenty of resources to enhance teaching skills and learning ability. ICT as a learning tool has provided immediacy to education. Through ICT students can learn any time any- where. Shah (1964) developed and validated linear Programmed learning material on equation solving and also evaluated its effectiveness against the conventional lecture method. Desai (1966) developed a Programmed learning material on "The Types of Compound". The results revealed that the programmed learning approach was more effective than the conventional method of teaching. Desai (1985) made an investigation into the efficacy of different instructional media in the teaching of science to the pupils of class VIII. The major findings of the study revealed that the programmed learning approach was more effective than the traditional way of teaching science. Mohanty (2010) find out the effect of programmed instruction on achievement of secondary school children in life science and found that students learn through programmed learning material achieved more as compared to the traditional approach in life science. Tabassum (2015) revealed that there is an improvement in student achievement when they are taught with the use of ICT tools. Devaki (2015) explained the multimedia teaching improves the understanding and achievement of students. Solanki (2015) suggested that teachers should uptake the use of a new multimedia module in the teaching-learning process. Singh & Husain (2015) used multimedia content in teaching of science and found it effective in improving the achievement level of students in hard spots of science.

Need of the Study

Since it was established by many pieces of researches that every student has different learning preferences, thus course material must be presented in such a way that no student unfairly gets disadvantaged. Often due to various circumstances, teachers may adopt a specific teaching method without considering the individualized needs of the group being taught. It may result in an unsatisfactory learning outcome from some students. Thus, when presenting learning material to students, all student learning styles must be supported. Further, the interaction between the learners and the learning material should be taken into consideration to improve the quality of educational outcomes (Alharbi, et.al., 2011).

Accommodating instruction to students with differences is one of the most fundamental problems of education since earlier to till date. The problem of

accommodation of individual differences is very important as many educators have suggested that instruction should be completely individualized so that the learners can work independently at their own pace. Children of today are the future citizens and they are going to be the pillars of the country. Hence, it is essential, that each pillar is as strong as the other (Balasubramanian & Meera, 2002). Somehow the problem of accommodation of individual differences in the learning of students can be overcome by the use of technology in education. When we focus on the contributions of technology in education, Programmed Learning seems like one of the most important contributions of educational technology for individualized instructions. Programmed Learning may be viewed as a standardized self- instructional system, in which the learner interacts with each step in a program presented through instructional material. Programmed Learning is a method of presenting the new subject matter to students in a graded sequence of controlled steps. Students can work through the programmed material by themselves and after each step test their comprehension by answering an examination question or filling in a diagram. They are then immediately shown the correct answer or given additional information. Computers and other types of teaching machines are often used to present the material. Computer-assisted instruction and computer-based instruction can be regarded as sophisticated extensions of programmed instruction theory and concept. It is also evident that computer-mediated instructions are based upon programmed instruction theory and research (Lockee et.al, 2001). Bangert Drowns (1985) concluded that computer-based delivery systems have a valuable role in supporting instruction. According to Satyarthi (2015), Learning modules and programmed learning have many features in common. The main principles of the module are self-explanatory, self-contained, self-directed, self –motivated, and self-evaluated as programmed learning is also based on these principles. Shikhare (2007) design and construct a multimedia instructional system on educational technology and revealed that the multimedia instructional system was found quite effective than the conventional method. Vellaisamy (2007) seems that multimedia has a favorable impact on the learning of science. Anderson (1996) developed a programmed lesson unit on 'Acids, Bases, and Salts' using a branching program and found this form of instruction is effective in improving the degree of learning accomplished by the students. Later, he developed a program on stoichiometry in chemistry in 2001. Desai (1966) developed a program on "Types of compounds" and program text on "Structure of Atom" developed by John (2012). Here, in the present study researchers tried to develop an ICT based programmed learning material on web page www. selflearnonline.com, which can be easily accessed by students anytime anywhere according to their pace and time. This program also provides an opportunity for remedial teaching which is helpful for the students who are getting their education from open education resources or distance mode.

Purpose of the Study

1. To Prepare the ICT based Programmed Learning Material on "Matter in our surroundings" and "Is matter around us pure" based on the content of the NCERT Science textbook for class IX Students.
2. To Evaluate the Effectiveness of ICT based Programmed Learning Material (PLM) as compared to the Conventional Method of Teaching (CMT) on the performance of class IX Students.

Research Methodology

Research Design: A Quasi-Experimental design was adopted for the study. This study involved the dependent variables as -Treatment Groups (Experimental Group vs Control Group), one independent variable as - Achievement scores of students.

Sample- For the present study 180 students of class IX who were studying in two private co-educational CBSE affiliated English medium schools were selected in the month of April 2017 by random sampling technique.

Tools

1. ICT-based Programmed Learning Material developed by the researchers.
2. The Pre and Post achievement tests were developed by the researchers.

Description of ICT based Programmed Learning Material

This ICT based Programmed Learning Material was based on the two chapters of class IX NCERT science textbook namely "Matter in our surroundings" and "Is Matter around us pure". Linear style as well as Branched style of programming had been chosen for this study. This ICT based PLM was divided into two Parts. Part -1 is based on "Matter in our surroundings". Part -2 is based on "Is Matter around us Pure". Part -1 divided into 7 subunits and Part-2 divided into 8 subunits. These subunits were divided into frames. There were a total of 55 Frames in this ICT based PLM. There were 21 Frames in Part-1 and 34 Frames in Part-2. These frames were arranged in sequence to allow learners to learn on their own. After reading with each frame the learners get immediate knowledge of their learning.

In any programmed learning material, the frame is the smallest unit of a program in which the learning material is presented in a small step. There are three different components in a frame stimulus, response, and reinforcement. In the present programmed learning material, each frame was presented in such a way that it had a stimulus in the form of information; the response part was presented in the form of multiple choice type questions in each frame after the stimulus. The immediate information about result given in the form of the correctness of answer that worked as a reinforcer for the learners. The prompts were given in each frame in the form of animated pictures to elicited correct responses from the learners.

Initially, it was prepared in PowerPoint by using hypertext, pictures, visual basics, and animations, etc. This ICT based Programmed Learning Material was uploaded on the website www.

selflearnonline.com with the help of technology ASP.NET, NET Framework4.0 IDE: Visual Studio 2010, and Database: SQL Server2012.

In this ICT based PLM firstly, students were instructed to do their registration. After registration process they were able to continue with their login. After opening of learning material students read each frame carefully and after reading the frame they answered the multiple choice questions given in each frame. After answering the questions students immediately got the responses like "congratulation" or "try again". If the students found their answer correct they continued their learning towards the next frame. If the students attempted the wrong answer then they continued with reading the frame again or students get back to the required frame where they can learn again. Students verified the correct answers and proceed to the next item or frame. The counting of responses was done mechanically. At the end of ICT based Programmed Learning Material students got their result reports.

Execution of Experiment and Collection of Data

The execution of the experiment and the collection of data for the present study took approximately one month's period that was fifteen days in each school. The first step was the administration of the pre-test. The pre-test administered to access the prerequisite knowledge of the students and also for the equivalence of control and experimental groups. In the second step, the experimental group taught through ICT based programmed learning material and control group taught through the conventional method of teaching. After the completion of the learning of both groups' experimental and control groups the post-test administered on both groups.

Analysis of Data

To analyze the effectiveness of ICT based PLM and CMT on the Achievement scores of the Students of Experimental group and Control group, the following hypothesis was formulated.

Hypothesis

There is no significant difference in the performance of students who taught through ICT based Programmed Learning Material as compare to the performance of the students who taught by the Conventional Method of Teaching.

To test this hypothesis, the F-ratio for the main effect of treatments was computed. To see the difference between the control and experimental group, the mean and standard deviation of post achievement scores were also computed.

Table-1: The F-value and Level of Significance for the Main Effects of ICT based Programmed Learning Material (PLM) and Conventional Method of Teaching (CMT)

Source of Variance	df	Comp. F-Ratio	Level of Significance
Treatment Groups	1	15.781	0.01

Programmed Learning Material (PLM) is more effective than the Conventional Method of Teaching (CMT).

Findings and Conclusion

In the present scenario in this pandemic situation, we are moving towards digital India and online education is acting as the most important tool in the progress of a country. It is the necessity of our country in the present time to use digital, ICT, computer-based devices in our education system. Digital India demands to do some fruitful contribution to digital content. Thus, in the present study researchers developed an ICT based programmed learning material on the topics 'Matter in our surroundings' and 'Is matter pure around us'. Letina & Dikovic (2012) conclude that programmed based teaching develops critical thinking; programmed teaching has the potential to produce positive learning environments that are supportive, structured, and, most importantly, directed towards training students for independent lifelong learning. ICT based Programmed material is also recommended for gifted students because it requires independence in their work and allows them to skip familiar content, but also it can be prepared for students with disabilities as a part of their individualized curriculum. Sozcu, Ipek & Taskin (2013) also discussed that conventional CBI generates new learning environments with instructional design approaches and e-learning technologies. Today, traditional CBI has extended to knowledge management systems to develop web-based learning, e-learning, distance education, and online systems, from face to face to virtual classrooms.

The results of the present study are also supported by Gupta (1976), Debi(1989), Thatte (1998), etc. developed programmed learning material and found that the programmed learning materials are more effective in the learning of students as compared to traditional methods of teaching. From the result of the present study and previous studies, researchers concluded that these kinds of ICT based programmed learning material can be used as a supplement with Conventional method of teaching as Spradlin (2009) also found that students performed equally well when receiving traditional classroom instruction and traditional classroom instruction supplemented with computer-assisted instruction. Thus, these kinds of ICT based programmed learning material can be used with conventional classroom learning to enhance the learning of students. From the present study, researchers concluded that in the making of digital India program and online education this kind of ICT based self-learning material can be used by the teachers to enhance the learning of students. It is also suggestive for researchers and teachers to develop more such kind of ICT based learning material for science and also for other subjects.

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