

3-D Printed Teaching Model and Its Use in Teacher Education Programme

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Abstract

Recently classroom teaching-learning is going through power-point presentation, Smart-Board, White-Board, Animation mode, Wikipedia mode, YouTube mode and Skype mode. These technique and mode of teaching are student active and encourages learners to keep concentration in learning as a result of high retention. Like these mode of teaching 3-D printed teaching model are using in academic, industrial technological and medical instruction in 21 century.3-D Printed teaching model encourages learner to perceive 3-dimentional concept of a particular object which is beneficial in teacher education programme. In Teacher Education Programme ,prospective teachers has to acquire different teaching skills ;like understanding of the lesson, explaining of the lesson and create motivation to the lesson .If teacher can teach with the help of 3-D printed model ,student understand the content better than traditional approach at the same time they are motivated for further learning. Basically science related subjects like Physics, Chemistry, Botany and Zoology should taught through 3-D printed model which will provide better outcome from the students. Now a day different type of research have been undertaken to improve teaching- learning process,3-D printed teaching model is one of the invention of them.Kothari commission says that “Our classroom will determine the destiny of India ”.Yes ,In future it will be determine the destiny of India if we apply the modern innovative teaching technique like, 3-D printed model.

KEYWORDS: 3-D Printed Teaching Model, Smart-Board, White-Board, Animation, Wikipedia, YouTube and Skype.

Background of the Study

Now a days, students are learning through YouTube, animation, Wikipedia, web 2.0, and other learning modes like; Skype, Imo and 3-D printed models. Out of these, 3-D printed models are creative, innovative, and attractive, does not need internet except the assistance of computer to develop the 3D printing models on different concepts. Visually impaired students successfully comprehend content taught in the classroom (Wonjin; Hee; Ananda; Hyun; Hyebin; Ju; Myoung-Woon, 2016). Like 2-D printing, the quality of 3-D printing is dependent on resolution, the number of primary colours and processing capability of printers. With the advancement of technology researcher wanted to see how this technology can use to benefit education. A group of researcher try to reach 3-D printers in every classroom or school or any teachers but they want to see how could 3-D printing in education make teaching and learning better? 3-D printed technology are most suitable for those curricula where students are required to do some hard thinking and solve the problem through proper design. 3-D printed technology benefit education through five major ways. These are, Create excitement, Compliment STEM curriculum, give assess to materials not available before, Open new possibilities for learning and promote problem-solving skills (Kristiel, 2014). 3-D

printed models are recently being used to provide better quality education to the learners. Different researchers developed different theories to apply 3-D printed models; however, most of them found that it has significant effects on achievement of the students. Interactive 3-D printed models enhanced the achievement of students (Brown & Abebi, 2015). Another study was conducted and found that teachers and students really motivated and convinced that prototyping technology will bring another revolution in education and achievement of the students of Pakistan (Waseem , Kainant , Qureshi & Hussain,2016).

3-D printing technology has great impact on cognitive interference of the students. Cognitive interference means students acquire new ideas with relation to previous ideas through 3-D printing and 3-D models. In recent era, there has been an explosion in the varieties and quality of 3-D printers and software. Various elements of the 3-D printing process have resonated with students, allowing them to understand traditional concepts in new and tangible ways. Development of a geometry curriculum for students using 3-D printing enhances the cognitive interference of the students (Cockran, Jil, Leaney & Mandi, 2016). Another study resembles that structure/function relationship of protein domains, namely Lucien zippers, through a molecular graphics computer program and physical models fabricated by 3-D printing strengthen the cognitive interference.(Mayer & Scott ,2015).

Learning Performance in Relations to Working Memory, Cognitive Interference and Cognitive Skills of Students

3-D printing technology has intrinsic relation with cognitive skills, like memory, perception, reasoning, critical thinking and problem solving. A study conducted by Kuo, Ming-Shiou; Chuang, Tsung-Yen, they found that the development of students' to visualise meta-skills, including design things, creativity thinking and the ability to visualise ideas from imagination through 3-D printing model (Kuo, Ming-Shiou, Chung, Tsung- Yen,2016). Artificial intelligence in Education (AIED) can benefit from integrating recent technological advances and design methodologies, such as TORMEs where developing systems that address the psychomotor learning domain. In particular, the acquisition of motor skills could benefit from individualised instruction and support just as cognitive skills learning has over the last decades only through the help of 3-D printing technology (Santos &Olga, 2016).

Rationale of the Study

Recently classroom teaching- learning is going through power-point presentation, Smart-Board, white-board, Animation Mode, Wikipedia Mode, YouTube Mode and Skype Mode. These modes are student active techniques encourage learners to keep concentration in learning because of high retention. Like these modes, 3-D printed models are the 21-century teaching tools those are using in academic, industrial, technological and medical instruction. 3-D modelling and 3-D printing encourages learner to perceive 3- dimensional model of the particular concept in the classroom. 3-D printed models do improve spatial reasoning about gender and age (Andrej, Bacracevic & sereko-2015). Literature found the application of 3-D printed models are the instructional materials were suitable to improve visually impaired students (Wonjin, Hee, Ananda, Hyun, Hybin, Ju &Woon-2016). Not only was this researcher suggested that computer-aided design software and 3-D models could improve spatial visualisation(Petross& Millie-2015). 3-D printed crystallographic unit cells used for drawing materials in science and engineering help high retention and performance (Rodenbough, Vanti & Siu-Wai-2015). 3-D model has certain influence on executive function of the learners. Literature found 3-D model is highly influential in a nature at

it has a direct influence on students perception (Matthew & Michael-2016). It is also found from the FMRI technology that 3-D model has certain impact on learning which was seen in the brain imaging (Ping, Lauren Jennifer & Victoria -2015). Literature found 3-D printed model has positive impact on students perception of learning (Karen & Mendez -2016). It is also found that 3-D model has direct effect on communicators' perception and decision-making quality (Lockwood-2014). 3-D computer modelling could help in the conceptual change (Huseyin, Emin ,Asuman & Kemal- 2009). There is no influence of age on the executive functions and students 3-dimensional model of learning (Delaloye et al. 2015). 3-D printed models could provide guidance for the development of teaching materials and models appropriate to learn partial ability (Huang & Yulin-2017). 3-D printed directly influence human brain tissue (Ploch, Mansi, Jayamohan & Khul-2016). 3-dimensional models could help to realise the concept for better understanding (Mohamad,Kogilatnah &Wee-2015).

Objectives of the Study

Based on the theoretical background, the current study has following objective:

1. To study the effects of 3D-printed models on the performance of secondary students over traditional approach.
2. To study the effects of 3-D printed models on the performance in relation to working memory of secondary students.
3. To study the variations in cognitive interference after being exposed to 3-D printed models in secondary students.
4. To study the effects of 3-D printed models on the performance of cognitive skills of secondary students.

Methodology of the Study

Design

The present study is a Pre test- Post test non-equivalent quasi-experimental design where random assignment to experimental and controlled treatment has not been applied (Cook & Campbell-1979). This design is often used in the classroom experiments when experimental and controlled groups are such naturally assembled groups as intact classes, which may be similar. Two physical science classes of any two schools of Alipurduar district was select for the experiment. One group was learn through traditional method and another group was learn through 3-D printed model technology. Pre test- Post test non-equivalent group design is completely free from randomisation where extraneous variable like, maturation, testing, regression, selection, mortality will be minimized through ANCOVA and Regression Analysis. The findings of the study was generalise on the whole population.

Population and Sample

The present study is a quasi-experimental design was use to assess the effects of 3-D printed models on working memory, cognitive interference and cognitive skills of secondary students. To conduct the experiment the researcher was follow simple random sampling technique to select the schools in Alipurduwar District of WB, India. The researcher will prefer ninth grade students' to experiment with 3D models of physical science. Here, all the 9th grade students of West Bengal were the population of the study.

Tools

1. Achievement Test

An achievement test was prepared on physical science by following all the standardised criteria like, planning, preparing, try-out and evaluation. Preliminarily, the researcher was prepared twice number of items and after consulting with the experts he finalised the number of items, domain and weightage. Accordingly content validity ratio, reliability also estimated.

2. Working Memory Scale

The researcher was developed the working memory scale. This scale has five sub-tasks, those are remembering, explaining, characterising, analogy and creating. The researcher followed all the criteria to construct the task to assess working memory. Validity, Reliability and time duration was established.

3. Cognitive Interference Task

The researcher followed Stroop Task (1935), Sarason's interference tasks (1988) to develop cognitive interference scale. These tasks have five sub-tasks those are Stroop task, stress and anxiety task, enjoyable and meaningful task, acquire response position task and compatibility task. The validity, reliability and time duration were established.

4. Cognitive Skill Task

Researcher was developed cognitive skill questionnaire by following all the standardised criteria. This scale has five sub-areas; these are: critical thinking, clear and effective writing, understands majors, logical reasoning and problem solving. Validity, reliability and time duration of this Task also established.

Analysis and Interpretation

In data analysis and interpretation section the researcher selected 60 samples from two secondary schools of Alipurduar District. All the four tools, i.e; Achievement Test Questionnaire, Working Memory Scale, Cognitive Interference task and cognitive skill scale was administered to all the samples. The researcher tried to work the data into a broad level framework consisting of three key concepts: working memory, cognitive interference and cognitive skill which are directly related to the research objectives. These three concepts became made the final categories of data and the framework from which the findings were drawn.

1. Working Memory of The Students

After the use of the 3-D Printed teaching model in the classroom the result found that student acquire comparatively better working memory than earlier when they were taught through traditional approach.

2. Cognitive Interference of The Students

When students were taught through 3-D Printed models in the classroom they always get proactive cognitive interference. They never get any kind of interactive cognitive interference.

3. Cognitive skills of the students

When students are taught through 3-D Printed models, they acquire better cognitive skills like critical thinking, clear and effective writing, understanding major, logical reasoning and problem solving. This model is more effective model to teach science subjects like physics, chemistry, Botany and zoology at secondary level.

Major Findings of the Study

1. The major finding of the study in perspective of method of teaching the 3-D printed models of teaching is more effective compare to traditional method of teaching. 3-D Printed teaching models make the classroom more attractive, interesting, alive and controlled over traditional method of teaching.

2. The major findings is that after using 3-D Printed models the remembering, explaining, characterization, analogy, and creativity factors of working memory of secondary students are increase.
3. The major findings is that when teacher used 3-D printed models in normal classroom the students get a proactive interference in relation to previous knowledge or ideas. After using 3-D Printed models students never get any kind of retroactive interference in secondary level.
4. 4.The findings is that when teacher teach with the help of 3-D Printed models the students will get better critical thinking, clear and effective writing, understand majors, logical reasoning and problem solving aspects of cognitive skills in comparison to traditional methods of teaching in secondary level.

Summary & Conclusion

Recently classroom teaching-learning is going through power-point presentation, Smart-Board, White-Board, Animation mode, Wikipedia mode, YouTube mode and Skype mode. These technique and mode of teaching are student active and encourages learners to keep concentration in learning as a result of high retention. Like these mode of teaching 3-D printed teaching model are using in academic, industrial technological and medical instruction in 21 century.3-D Printed teaching model encourages learner to perceive 3-dimensional concept of a particular object which is beneficial in teacher education programme. In Teacher Education Programme ,prospective teachers has to acquire different teaching skills ;like understanding of the lesson, explaining of the lesson and create motivation to the lesson .If teacher can teach with the help of 3-D printed model ,student understand the content better than traditional approach at the same time they are motivated for further learning. Basically science related subjects like Physics, Chemistry, Botany and Zoology should taught through 3-D printed model which will provide better outcome from the students. This study suggests that 3-D Printed model have more effectiveness compare to traditional approach in relation to working memory, cognitive interference and cognitive skills of students .In the concluding sentence we can say from the preamble of Kothari commission “ The destiny of India is being shaped in the classroom. ”.Yes ,In future the destiny of India will be shaped by the classroom if we apply the modern innovative teaching technique like, 3-D printed model along with other innovative teaching strategies.

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