Digi Maths: Impact of Technology on Mathematics Teaching in Classroom

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Abstract- *Mathematics teaching has been facing the challenge of reducing the fear of mathematics among students at school level from a very long time. An effective teaching and learning of mathematics at this level has been a challenge for school teachers.*

Technology can be a very effective way of addressing the above problems and improve the teaching learning of mathematics in classrooms. Although effectiveness of technology in classroom depends on various factors but an in depth study of its implications can help us in improving our pedagogies.

In this Action Research study, we tried to find out the difference in technology enhanced mathematics classrooms and traditional classrooms with respect to students academic achievement and student motivation. We also hoped to find that how teachers and students can use technology effectively in classrooms and what type of use can be done.

In order to do the above study we took two experimental groups of students studying in Class VI, and taught them the same concept separately in technology enhanced classroom and in traditional classroom. We analyzed the performance of the students in both the classrooms by taking written tests and classroom observations.

Our analysis showed that technology can enhance student academic achievement and can motivate students to a large extent. A well planned integration of technology in school curriculum can result in achieving much higher goals of mathematics teaching.

Keywords : *Technology enhanced classroom, Traditional classroom, Mathematical Exploration, Pedagogy, Tab Lab, Curriculum, Teaching, Khan Academy, FUNTOOT, CUPA*

Introduction

According to NCF 2005, the core area of concern in Mathematics Teaching in India is a sense of fear and failure regarding mathematics among the majority of students. Our curriculum is disappointing a talented minority as well as the non participating majority at the same time.

In the last decade lots of investigation has been done internationally on how to improve the existing situation of science and mathematics teaching, and educational researchers' have

expressed high expectations for the computer and other technology in improving the teaching and learning of mathematics.

A number of different technologies are being used in today's mathematics classrooms with varying degree of success. Recent researches indicate that the purposeful use of technology in classroom can indeed enhance student's outcomes. Technology can greatly aid the process of mathematical exploration, and clever use of such aids can help engage students.

My school, located in Noida serves approximately 2500 students out of which around 600 students are enrolled in Middle School (VI – VIII). For the past two years, the school has been integrating technology into classrooms through various programs. With a well trained staff, our school currently possesses a technology enhanced ATL Tinkering lab for effective science communication and a TAB Lab for integrating technology with mathematics with a capacity of 50 students.

With the help of different Applications like Khan Academy, FUNTOOT etc, we are introducing technology in regular mathematics classroom and trying to address different issues related to teaching and learning of Mathematics. As a member of the School's Mathematics Department and In charges of Tab Lab, We are especially concerned with the effects of technology on students' achievements in mathematics.

Much is available on how technology or other innovative pedagogies can be useful in the mathematics classroom. Although research concerning the effects of technology is increasing, most studies are set in foreign countries with entirely different cultures than ours. There is little research concerning the effects of technology on mathematics achievement of middle school students in India. This lack of research suggests that an investigation of the differences between a technology enhanced mathematics classroom and a traditional mathematics classroom in affecting mathematics achievement would be a valuable addition to the literature.

The purpose of this action research study was to compare the effects of technology enhanced mathematics classroom and traditional mathematics classroom in terms of students' academic achievements and student motivation. In doing this comparison we hope to gain an understanding of how technology can be used effectively for the achievement of mathematical goals set by NCF 2005. In our study, we concentrated on two methods of instructions, technology enhanced and traditional. I define technology enhanced instruction as an instruction that use computers or tablets with internet and different software that can be used for explaining a concept or question solving related to a particular concept. Traditional instruction was instruction that did not include computer related technology such as software, Internet etc but may include the use of Maths Lab Activities and Smart Class.

The area in which we were studying the effects of instructions was student academic achievements and student motivation. Student academic achievement was measured as an

increase in marks scored by students in written tests and Student motivation was a student's willingness to learn mathematics as evidenced by student's participation.

Research Questions

1. How does technology enhanced mathematics classroom compare with traditional mathematics classroom in student academic achievement and student motivation?
2. How technology can be used by teachers and students in mathematics classroom? To what extent? How frequently? What are the types of use?

Methodology

Participants

The study included two teachers and 46 sixth grade students. There were approximately the same number of male and female students (46% boys and 54% girls) and two female teachers involved in the study.

Our school and its sister branches conduct a Common Understanding and Proficiency Assessment (CUPA) every year for Classes VI – VIII for Mathematics and English, in order to identify the teaching learning gaps. All the students of class VI who scored less than 50% marks in the above said test for mathematics were selected for this study. CUPA Mathematics for Class VI was based on the syllabus of Class V taught in our school and its sister branches.

The motive behind selecting the underachievers was to make sure that a true impact of technology can be assessed and students can be motivated for mathematics learning.

The whole group was divided into two equal groups selected randomly. One group was taught in technology enhanced classroom and the other group was taught in the traditional classroom.

Interventions

In order to study the effects of integrating technology into the mathematics classroom, we studied several interventions that were already being implemented in the classrooms. The interventions included 1) Using the Tab Lab (50 Tablets) for computerized instructions 2) Using Khan Academy videos for enhancing the understanding of a concept 3) Using the exercise modules of Khan Academy for rigorous practice of a concept. These interventions were used to teach Fractions using various videos and modules and to practice the questions.

In the traditional classroom none of the aforementioned interventions were present.

Measures

In order to compare the technology enhanced mathematics classroom with traditional mathematics classroom in student academic achievement and student motivation, I used the following measure:

- A written Test based on fractions and teacher comments to measure students' academic achievement in both technology enhanced and traditional classroom.

- To measure the level of student motivation, I observed both mathematics classrooms.

Procedure

Our study included a group of 46 students of Class VI and teaching of Fraction, selected on the basis of their scores in CUPA and analysis of the CUPA result to identify the teaching learning gaps. We chose to include Class VI as we feel that the students belonging to this age group can easily adopt different innovative pedagogies and help in bringing out a fair conclusion.

We divided the group into two small groups consisting of 23 students each selected randomly. One group was taught Fraction in technology enhanced classroom and the other group was taught the same topic using traditional teaching methods.

In the technology enhanced classroom, teacher used various videos along with the traditional chalk and blackboard method to teach a concept related to fraction and then different exercises were assigned to them using Khan Academy modules to solve in the classroom and at home.

In the traditional classroom, the same concept was taught by teacher using chalk and blackboard and other lab activities, worksheets were also administered on students for better understanding

All data was collected in the mathematics classroom during the regular class period. The content based test was administered after the end of the topic Fraction.

The class observation had also been during regular class period in order to measure the student motivation. No special instructions were given to the students during the classroom observation or written test.

After collecting all the data, we analyzed the data to seek answers to the research questions. To compare the technology enhanced classroom with the traditional classroom, I organized the data collected from the classroom observation and written test into a Microsoft Excel Workbook and used Excel to calculate the descriptive statistics and do the final analysis.

Result

Student achievement

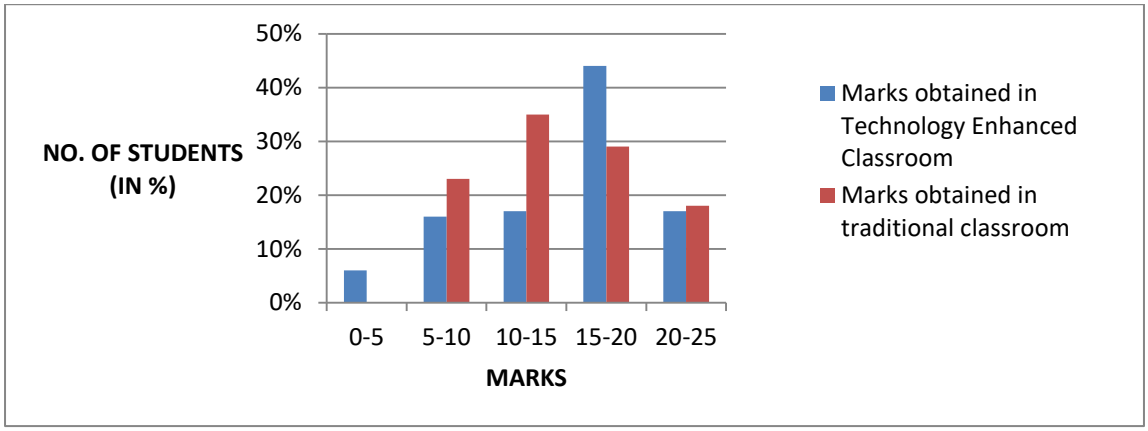
In reference to the research question concerning how technology enhanced classroom compare with traditional classroom in student academic achievement, the results of my studies were quite interesting. The class average of the test conducted at the end of the sessions of both technology enhanced classroom and the traditional classroom was quite similar.

- The average of technology enhanced classroom was **15.5 out of 25**
- The average of traditional classroom was **13.4 out of 25**

	Technology Enhanced	Traditional
CUPA Average (%)	25.3%	19%
Final Test Average (%)	62%	54%
Average increase in marks (%)	36.6%	34.8%

Table 1: Average marks scored by students in both test

Marks Distribution in Technology Enhanced and Traditional Classroom



In the technology enhanced classroom, 89% of students have reported higher grades than the previous paper in the same topic and 11% students have reported the same grades with no improvement.

In the traditional classroom 88 % students have reported the higher grades whereas 12 % students have reported grades lower than the previous paper.

	Technology Enhanced	**Traditional**
Higher	89%	88%
Same	11%	NIL
Lower	NIL	12%

Table 2: Students grade after using technology or not using technology

We observed that the average score of students who studied in technology enhanced classroom is slightly more that the average score of students in traditional classroom. The average increase in the marks obtained by students is also more in technology enhanced classroom than the students in traditional classroom.

Student Motivation

As per our observation, the students in the technology enhanced classroom are more motivated than the students in traditional classroom, which was evident by their level of participation and their interest in answering and solving of the questions.

Discussion/Analysis

The purpose of this Action Research Study was to find the difference between a technology-enhanced mathematics classroom and a traditional mathematics classroom in terms of students' academic achievement and students' motivation. In doing this comparison, we also hoped to find how technology can be used by teachers and students in the classroom, to what extent and how frequently. Though most of our results supported our prior beliefs, but there were some surprises too.

Students' Academic Achievement

In reference to my first research question, how technology enhanced mathematics classroom compare with traditional mathematics classroom in terms of students achievement, our results show that technology enhanced classroom has more academic achievement than traditional classroom, which support our prior beliefs. However the average increase in the marks for both the classroom differ slightly only, and no major difference can be seen. This can be explained by the fact that our class size for both technology enhanced and traditional classroom was quite small. In India, the average class size in a school is more than 50 students, which in itself is a big challenge for a teacher as the probability of giving individual attention get reduced to a large extent.

In technology enhanced classroom, the number of students will not create much difference as every child is working individually and learning with his/her own pace. It's easy to create a personalized lesson plan for a child according to his/her needs in a technology enhanced classroom. A technology enhanced classroom promotes inclusive education as we can cater the needs of every student.

Another factor could be that, using a technology could in itself be a challenge for some student and a distraction for some. In order to have effective learning with the help of technology, we need students who are well trained and understand the importance of correct usage of technology.

Student motivation

We observed that students in technology enhanced classroom are more motivated in comparison to the traditional classroom which also supports our prior belief. Technologies like tablets etc interest the students more than the routine books and notebooks and could be a major factor behind this motivation. Using Tablets with different Applications also help in eliminating the fear of mathematics among students. Another factor which according to us played an important role was the fact that solving questions online give them instant results which promote the zeal of improving and introduce a healthy competition among the students.

Every student learn differently and have his/her own pace of understanding things, technology enhanced classroom gives them the opportunity to learn with their own pace and hence motivate them more.

The underachievers can do more and more practice and can revisit the same concept again till they understood it, whereas a high achiever can easily move ahead and solve questions of higher concepts without disturbing the other students, which in itself is a big motivation for everyone.

While working for this Action Research project, we realized that technology can definitely improve the quality of mathematics teaching and learning, but it cannot overcome the need of a teacher. A well trained and dedicated staff is a pre requisite of a technology enhanced classroom. Also we cannot undermine the Learning by Doing pedagogy as learning something by doing it and learning it through a video have different impact. Both of them are complimentary to each other.

In reference to my second research question that how technology can be used in classroom, my findings are that technology can be a good tool for assessment of concepts as it provides an easy access to large number of questions and provide instant results, and the videos can help in visualization of certain concepts. The technology can be integrated in the curriculum and used weekly for assessment or as per the requirement of the concept.

Each one of us can find out a different and more effective way of using technology in our classroom, as per our students and curriculum.

Conclusion

As we stated in the introduction, the main concern in mathematics teaching in India is how to reduce the fear of mathematics among the students and how to cater the different needs of specially abled, underachievers and high achievers in our classrooms. As per many research conducted earlier, technology can be an effective way of dealing with above said problems, but how effective it could be in Indian context and in our classrooms was our major concern and framed the research questions of our study.

We conducted an Action Research Project in our school and found out that a technology enhanced classroom can help us in achieving our goals of mathematics teaching. Technology can definitely help us in eliminating the fear of mathematics by making it a fun subject and can also help in catering the needs of different students in one classroom.

Technology enhanced classrooms were more motivating in comparison to the traditional classrooms and students achieved higher grades in them. Our research shows that integrating technology in our classrooms can definitely help in achieving higher grades and motivate a large number of students.

However the achievements in technology enhanced classroom and traditional classroom in our study were not very different and were quite similar, which could be due to the small size of our experimental group. The similar study by taking a large group and students with different interest and background may yield more appropriate and effective results.

Overall, we concluded that a clever and well planned integration of technology in our regular classroom can definitely help us in improving mathematics teaching and learning process and motivate a large number of students.

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