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Original Research Article

EFFECTIVENESS OF USE OF ONLINE TOOLS IN MATHEMATICS LEARNING OF SECONDARY STUDENTS: AN EXPERIMENTAL STUDY

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Abstract

When schools shifted to the virtual platform due to the pandemic, instructional process has undergone a paradigm shift. Assisting this online education there is a wealth of online tools available that can supplement the teacher with information needed for teaching and providing the students with options for their learning. The objective of this study is to explore the effectiveness of use of two online tools Desmos and Robo-compass during online teaching in the mathematics achievement of standard 9th students of two schools in Mumbai. A pre-experimental static group comparison design was employed in the present study. The experimental group was taught two content areas in mathematics using the web tools while the control group was taught the same content through regular online teaching. The post-test achievement scores of both the groups were compared using t test. Inferential analysis resulted in the acceptance of null hypothesis. The result is discussed and presented.

Keywords: *Online Tools, Mathematics achievement, online teaching*

Introduction

When covid-19 disintegrated the normal life of people worldwide, the virtual world came to its rescue. Along with other institutions, schools also shifted to the virtual platform to continue with its classes to ensure that learning didn't stop for students. Interestingly, online teaching has emerged as an excellent alternative to regular face-to-face teaching. Online teaching helps in learning from any part of the world. This helps in saving time and money which could have been spent on commuting. Online education offers flexibility in the sense that the teacher and the taught can set their own teaching-learning pace. The current trend may persist post pandemic and there can be a greater shift towards use of online classes and resources in the future education practices.

Assisting this online education there is a wealth of online tools available that can supplement the teacher with information needed for teaching and providing the students with options for their learning. Online learning tools refer to any program, app, or technology that can be accessed via an internet connection and enhance a teacher's ability to present information and a student's ability to access that information.[1] Large numbers of digital tools are created with the purpose of providing autonomy to the students, easing administrative processes, making evaluation system robust and facilitating communication between learner and teacher. Online teaching can facilitate collaboration through various interaction tools, PowerPoint forums, blogs, on-line discussion groups

[1] https://study.com/academy/lesson/what-are-online-learning-tools-definition-types-examples.html

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and media, live chat, live visual communication and written chat tools (Beldarrain, 2006; Collis, De Boer, & Slotman, 2001; Jung et al., 2002)[2].

In online mathematics teaching, transaction of mathematical facts, concepts and steps of problem solution has to be developed through effective student teacher interaction to ensure successful achievement of learning objectives. This cannot be achieved solely through the use of keyboard and power points. Uses of online tools provide opportunities for leaners to see and interact with mathematical concepts to develop solutions to problems. Desmos and Robo-compass are two web tools that can be used in the teaching of algebra and geometry. Web tools are online tools which works using web technologies, specially http, html, js & css. Robo-compass is a geometry tool that can be used for constructions and Desmos is an advanced graphing calculator. Several studies have confirmed that using digital tools contributes excellently towards students' achievement of learning objectives. However, there are limited studies focusing specifically on the effectiveness of online tools Desmos and Robo-compass in learning of mathematics concepts. Therefore, this study aims to explore how these tools can support online mathematics teaching and contribute towards leaner achievement.

Title of the Study

Effectiveness of Use of Online Tools in Mathematics Learning of Secondary Students:
An Experimental Study.

Operational definitions of the Terms

Online Tools: online tools or web tools are programs or applications available through the internet which can enhance teacher's ability to present information and enhance student's ability to access and use that information. In the present study online tools refer to applications like Desmos and Robo-compass which are used in Mathematics teaching.

Mathematics Learning: It refers to the achievement scores of students as measured using a written test.

Secondary Students: Secondary students are students studying in standard 6 to 10. In this study students of standard 9 studying in board of Maharashtra state were considered.

Experimental Study: It is study in which the investigator controls conditions to test the efficacy of an intervention measure in order to provide the strongest evidence about the existence of a cause-effect relationship.

Statement of Aim

To study the effectiveness of the use of online tools in Mathematics learning of Secondary students.

Objectives of the Study

- To plan and prepare lessons for teaching certain content area in Mathematics for standard 9 using online tools, Desmos and Robo-compass.
- To implement the lesson using online tool Desmos and Robo-compass.
- To find the effectiveness of the use of the Web tools by comparing the Mathematics achievement scores of the control and the experimental group.

[2] As cited in Karal,H., Kokoc,M., Colak,C., & Yalcin.Y. (2015). A Case study on online Mathematics teaching with Pen-based technology: Experiences of two instructors. *Contemporary Educational Technology, 2015, 6*(4), 319-337.

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Hypothesis of the Study

For the present study the following null hypothesis was formulated.

There is no significant difference in the mean values of the achievement test scores of the experimental and the control group.

Sample of the Study

The sampling adopted for the study was convenient sampling. The students of the schools where the researchers were doing internship were selected as the sample. The sample consisted of total 30 students (15-control group and 15- experimental group) of standard 9 of Bandra Hindu Association School and VVK. Sarma High School.

Tools of the Study

1. Mathematics achievements test: A mathematics achievement test designed to gauge the students' achievement of objectives for content areas geometric construction of triangles and percentage bar graph.
2. Teaching learning package using Robo-compass tool: Robo-compass is an online geometry tool for creating constructions It is an interactive construction board that can be used to create drawings and animations using Geogebra to explain different concepts in geometry and algebra. Lesson plan incorporating the use of robo-compass to teach the topic construction of triangles was prepared.
3. Teaching learning package using Desmos tool: Desmos is an advanced graphing calculator used for plotting equations and other classroom activities to help students learn about a variety of math concepts. Lesson plan incorporating the use of Desmos to teach percentage bar graph was prepared.

Methodology of the Study

The method adopted for the study is a pre- experimental design of the experimental method. Experimental design can be Pre-experimental, True experimental and Quasi-experimental design. Types of Pre- experimental design: One-shot case study design One-group pre-test -post-test design Static-group comparison.

Design of the Study

A pre-experimental Static group comparison design is employed in the present study. In the static group comparison study, two groups are chosen one of which receives the treatment and the other not. A post-test score is then determined to measure the difference after treatment between the two groups. Observed differences between the two groups are assumed to be a result of the treatment.

X O

C O

X = Experimental Group

C = Control Group

O = Post Test.

The experimental group was taught two content areas using web tools in online teaching. The content areas are Construction of triangles using the web tool Robo-compass and drawing percentage bar graph using Desmos. The control group was taught the same content areas through regular online teaching.

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Statistical Analysis of the Results

The data was statistically analysed both descriptively and inferentially. For descriptive analysis- mean, median, mode and standard deviation of the post-test mathematics achievement scores of the control and experimental group were done. For inferential analysis, a hypothesis testing was done using t-test.

Descriptive Analysis of Data

The post-test Mathematics achievement scores of the data were analyzed descriptively by calculating mean, median, mode and standard deviation.

These values are presented in the table -1

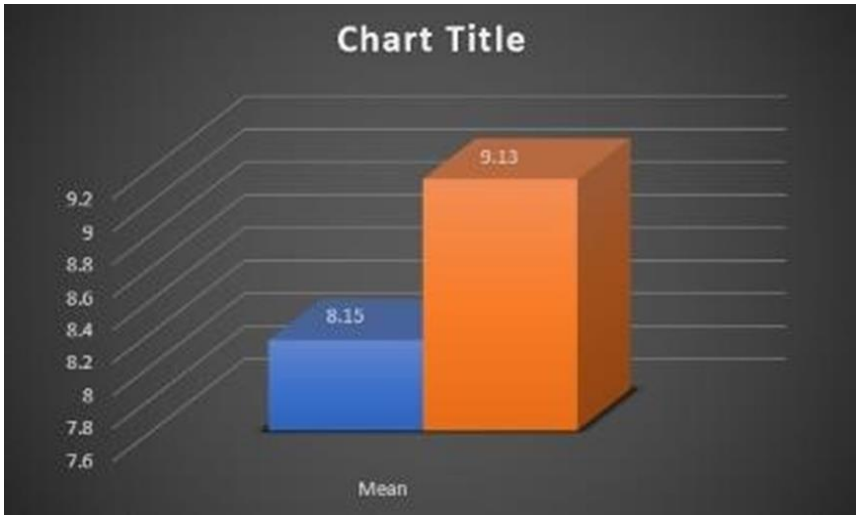
Table-1 Table showing Descriptive Analysis of Data

GROUP	TEST	MEAN	MEDIAN	MODE	STANDERD DEVIATION
CONTROL	POST-TEST	8.53	9	9	1.09
EXPERIMENTAL		9.13	10	10	1.15

Analyzing the post-test mean values of the mathematics achievement scores of the control group and the experimental group it is observed that the mean value of experimental group is slightly higher than that of the control group. In the post test, the mean value of Mathematics achievement scores of control group is 8.53 and the mean value of the mathematics achievement score of the experimental group is 9.13. The values indicate that the experimental group has a slightly improved Mathematics achievement scores than the control group.

The post-test scores of control and experimental groups are compared graphically using Joint Bar Graph as follows:

Graphical Representation of the mean of the post-test scores of the control and experimental groups



Control group. **Experimental group.**

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The above graphical representation shows that the post-test mean of mathematics achievement scores of the experimental group is slightly higher than that of the control group.

Inferential Analysis of Data

Hypothesis Testing

The following Null Hypotheses was framed to understand the significance in difference of the post-test mathematics achievement scores.

There is no significant difference in the mean values of the achievement test scores of the experimental and the control group

The inferential analysis is presented in table -2.

Table-2 Inferential Analysis of Data

TEST	GROUP	N	Df (N-2)	MEAN	STANDARD DEVIATION	t-VALUE	t-Table value
Post – test	Control	15	28	8.53	1.09	1.42	0.01 level equals 2.763
	Experimental	15		9.13	1.15		0.05 level equals 2.048

The table value of t at 0.01 and 0.05 levels of significance are 2.763 and 2.048 respectively. For the post-test, the calculated t value of 1.42 is lower than the table values at 0.01 and 0.05 levels of significance. So, the null hypothesis is accepted. There is no significant difference in the post-test mathematical achievement scores of the control and experimental groups. Hence the Null hypothesis is accepted.

The acceptance of null hypothesis indicates that there is no significant difference in the effectiveness of the use of online tools Desmos and Robo-compass in online teaching of mathematics and regular online teaching of mathematics.

Discussion of Results

Inferential analysis of the data of the present study resulted in the acceptance of the null hypothesis indicating that there is no significant difference in the effectiveness of the use of online tools Desmos and Robo-compass in online teaching of mathematics and regular online teaching of mathematics. This result can be elaborated with the following explanation. Several studies have confirmed the effectives of use of online tools in the teaching learning process through better student achievement of the learning outcomes. A deviation from these findings in the present study can be attributed to the following reasons.

- The time used to teach with each tool was less.
- Only one topic was taught using each tool.

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- The sample size was small.
- Two teachers were involved in the study teaching each groups- one teaching the experimental group and the other the control group. One teacher taught using online tools while the other taught using regular online method.

Hence, it is suggested that further studies may be carried out with the use of tools Desmos and Robo-compass in teaching of mathematics. These studies can use the tools for teaching more content area in mathematics at the same time dedicating more time to it so that students get adequate time to practice and use them. Studies exploring the effectiveness of usage of more online tools in teaching of mathematics may also be done.

Conclusion

Using online educational tools everyday has become the new normal for students during the lockdown. The present study tried to know the Effectiveness of use of two online tools in mathematics learning of secondary students by teaching two groups one using the tools in online teaching and another by regular online teaching. The results of the study showed there is no significant difference in the effectiveness of use of online tools in online mathematics teaching and regular teaching in online mathematics teaching. Maybe due to the time period for which the study had conducted was less. If the study could be administered for longer time, by using more online tools, more topics and more sample size, there might be an increase in the overall effectiveness of online education in teaching mathematics subject on students. Hence, it is warranted for more studies in the area.

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