Research Article

ICT Enhanced Instruction in Mathematics Sprucing Up Students' Achievement

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Abstract

Mathematics is treated as one of the most important subjects but along with it, it has the most dreadful effect on students. Students view Mathematics as complex, dull, boring, and stereotyped. The National Policy on Education 1986 alluded that "Mathematics should be visualized as the vehicle to train a child, to think, reason, analyze and to articulate logically. There is a shift in treating mathematics education as an instrument for National development as well as the development of a child's abilities." For attaining this objective, ICT is phenomenal. The research shows that ICT makes the learning environment vigorous and more captivating by engaging all the senses. The effectiveness of ICT-enhanced instruction can be perceived as a vigorous educational process for encouraging learners to think critically and creatively, analyze the acquired knowledge or skill, have insight into it, associate it with gained experience and apply it first-hand. After the initial reforms of ICT got well underway in other domains of education, it became quite evident for the researcher to see the impact of ICT on her subject and in her area. This research investigates the impact of ICT-enabled programmes created on Geometry content and comes out with a significant sprucing up of student's achievement.

Keywords: ICT Instruction, Mathematics Achievement, Effective Learning, Geometry Skills & Students

"Like the crest of a peacock, like a gem on the head of a snake, so is mathematics at the head of all knowledge." Vedanga Jyotisa (c. 500 B.C.) For promoting Maths in contemporary learners, ICT is proving itself by escalating student's achievement via manifold tools, equipment and applications by connecting them to symbolic mathematical concepts with dynamic visual representations.

Introduction

In the present era, Mathematics is taught as one of the important subjects in Indian schools, colleges, and universities. But, the majority of students feel that Mathematics is a complex, dull, boring, and stereotyped subject that leads to a lack of interest in mathematics. The paramount effort of every teacher is invariably to improve their student's ability and to equip them for the time ahead. The National Policy on Education 1986 alluded that "Mathematics should be visualized as the vehicle to train a child, to think, reason, analyze and to articulate logically. There is a shift in treating mathematics education as an instrument for the National development for the development of child's abilities." Capabilities are enhanced when qualitative instructions are used for teaching along with ICT. Students get benefitted from qualitative instructions by getting engaged in class with interest and gaining mastery of the content through it, which will help in measuring

student achievement in recommended time intervals. ICT has gained traction as an instructional strategy which helps in gaining qualitative instruction supporting student learning (Bloxham, 2005; Stuart, Mills & Remus, 2009) and enhancing student achievement (Kellar, Mackay, Zhang, Watters, Kaufman, & Borwein, 2003; Sosin, Blecha, Agawal, Bartlett, & Daniel, 2004; Coates & Humphreys, 2004).

The Pandemic has induced appalling agony in the whole world. The coronavirus outbreak has posed serious challenges and calls for evolution to resume and persist. Our immediate challenge is to educate children where they are, within the infrastructure and setting they are in. ICT has sprung up as a most prodigious tool for educating in tandem with the internet. It has overcome all sorts of setbacks of distantly learning. In this pandemic era, all schools are taking their classes online. It has come up with various online teaching learning tools and strategies that are able to enhance interaction, foster engagement, and provide immediate feedback. In this way, ICT resources provide many ways for ICT-based learning in all subjects and mathematics as well. It has paved the way for learning at its own pace and self-exploration. It succeeded in empowering students and teachers for making significant contributions in this pandemic era.

Miscellaneous researches elucidate the effectiveness of ICT integration as the practical aspect to enhance quality and bring forth productive results. It enables the teaching-learning process to strengthen its quality, improves access to content and resources, fosters learning, provides immediate feedback, supports a number of teaching strategies, promotes student engagement, boosts up skills and elevates the effectiveness of teaching-learning. Levin (2005) proclaimed ICT has transformed the ways of living, working and communicating. Forthcoming generations are supposed to have global awareness and understanding of multiculturalism. This generation has switched from being passive recipients to active participants in the information transfer model of learning. This revamps of curious learners has led to a reinforcement of bolsters in mathematics which is going to consolidate new skills of conceptions, reasoning and operations in mathematics. In this way, curriculum and methods of teaching also transposed from a behaviourist approach employing role play and tactics and strategies to an interactive problem-solving approach in a particular framework.

It is provided to be a more effective tool for students, teachers, and administrators in the school. ICT is used in different subjects like science, maths, and social science in various forms. It is an effective medium of teaching and learning. A Teacher uses technological devices such as power-point presentations, video, YouTube lectures, animation, audio, Graphing, and Geometrical tools to encourage interaction with students to share their knowledge and skills.

Review of Literature

A thorough review of the research showed that ICT is widely used at all levels of education in this pandemic scenario. Many studies found that the availability of ICT resources and their use had positive effects on students' achievement. Ishaq (2020), José et.al. (2020), Bora Ashim et al. (2018), Mondal et.al (2012), Bature, B.(2016), Zakaria, N.A. & Khalid(2016), was conducted to see the effectiveness of ICT in mathematics learning. These researches were based on learning mathematics, Geogebra, Powerpoint, online–Lecture, Multimedia packages,

and computer-based instruction. The amalgamation of ICT in mathematics fabricated an emphatic environment among secondary school students in their learning. The findings of the above research depicted that the relationships between different types of ICT resources used with Mathematics achievement had shown a positive impact. Besides, self-confidence was developed among the students in conducting ICT-related activities. ICT with a focus on enhancing essential skills accomplish the teaching learning effectively by fostering student engagement. It has an optimistic consequence on engagement, autonomy, high-order thinking, motivation, mathematical concepts, results and grades. Henceforth, ICT is considered an efficient tool for its pursuit of mathematics achievement. The conclusion drawn from the review helped the investigation properly in the design of the study

Rationale of the Study

Over the past decade, technology has struggled in various ways to quantify its progress in education towards technology standards. In this information era, students must be able to voluntarily access information from a reservoir of resources, analyze, evaluate, work collaboratively, think enormously and constructively, integrate and reflect on the learning process. ICT has become such an influential tool that it has provided new roles for teachers and students during this pandemic. It succeeded in giving new directions in teaching mathematics and enhancing the understanding of students towards basic concepts. With the help of ICT, teachers are able to improve their skills and find enormous ways of presenting the content. Mastery of mathematical content, pedagogy with technology integration in tandem with knowledge about research outcomes culminates in teachers' tenacity to plump on the usage of new technology in their classroom for enhancing their technology-integrated performance. Another possible explanation is that different analysis methods of ICT had been used in different mathematical concept research. Also, ICT has developed rapidly, the different tools and software for students learning. After the review of the literature, very few researches related to the usage of ICT were found by the investigator in the geometrical concept of mathematics. This area of research needs to be explained more. Hence, the current investigation aimed to see the effect of ICT on the geometrical concept of mathematics.

Objectives of the Study

1. To find out the impact of ICT-based teaching on the student's achievement in mathematics.

2. To compare the experimental group and control group based on achievement in mathematics (Post-test scores only).

Hypothesis of the Study

1. There exists no significant impact of ICT-based teaching on the student's achievement in mathematics.

2. There exists no significant difference of ICT-based teaching and traditional teaching on the student's achievement in mathematics

Methodology

A Quasi-Experimental design was adopted for the existing study. It is an attempt to see the effect of ICT-enabled programmes on the students' mathematics achievements related to the Geometry content of mathematics. The experimental group was taught through an ICT-enabled programme and the control group was taught through the traditional method.

Sample

The existent study was piloted on a sample of 80 students studying in Kanya Gurukul Senior Secondary School in Khanpur Kalan District Sonepat, Haryana. Out of 80 students, one group was formed as a control group, and the other group was formed as an experimental group.

Tool used: Various Tools chosen and used by the investigators are given below:

- Mathematics Achievement Test by Dr. Reena Rani &Dr. Anisha (2018)
- ICT-enabled Programme Developed by Investigators.

Description of the ICT-Enabled Programme

The ICT programme was based on nine units of Geometry for the class IX NCERT Mathematics textbook. For this Experimental Work, software was developed on MS PowerPoint by using text, pictures, animation, sound and bright colours for imitation and using the most commonly used software. Computer CD-ROM technology" as a medium for ICT used teaching technology. The CD-ROM, entitled, “Mathematics Geometry,” was developed as a PowerPoint Programme, comprising the storyboard including text, instructional design and possible graphics, audio and video. To minimize the overload of children, concise information is used. PowerPoint features such as slides, background colour, text selection, fonts with appropriate size, graphics and proper animation were used to finalize the package, covering the total content in 40 lecture demonstrations. The slides can switch back and forth with a mouse click or such arrow keys on the keyboard and the developed package was enhanced in compact disc (CD). The Surface Areas and Volume of different solids like cubes, cuboids etc. can be shown in animated form with their day-to-day examples. Thus the animated diagrams with different pleasant colour combinations and full of extra allied information were made available to the students.

Execution of the Experiment & Data Collection

Execution of the experiment and data collection for the present research took forty days. Before the commencement of the experiment, the pre-test was administered to know the prerequisite knowledge of the ninth-grade students in geometry. In the next step, the experiment group was taught through the power point programme and the control group was taught through conventional methods. The teaching was conducted by the investigator herself. After the completion of the experiment, the post-test was administered to both groups and data was collected.

Results & Discussion

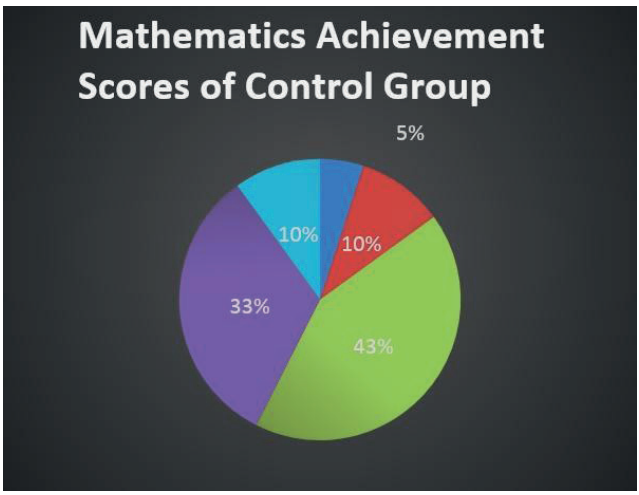
The finding of the research indicates that students who had learned Geometry content by using ICT-enabled programmes were significantly better in their Mathematics achievement as compared to students who underwent traditional learning.

Table-1: Findings of Use of ICT-enabled Programmes between students

Sr. No.	Class Interval	Mathematics Achievement Scores of Control Group		Mathematics Achievement Scores of Experimental Group	
		Frequency	Cumulative Frequency	Frequency	Cumulative Frequency
1.	0-5	2	2	0	0
2.	6-10	4	6	0	0
3.	11-15	17	23	1	1
4.	16-20	13	36	2	3
5.	21-25	4	40	6	9
6.	25-30	0	0	17	26
7.	31-35	0	0	12	38
8.	36-40	0	0	2	40

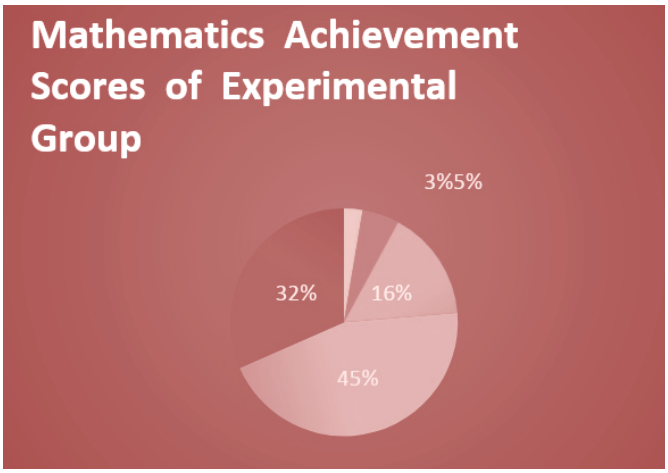
On the basis of scores, it is inferred that the Experimental teaching method proved useful. The findings showed that information and communication technology as a supplement to classroom instruction is more effective than traditional instruction.

Figure-1: Mathematics Achievement Score of Control Group



The pie chart on Mathematics scores of the control group shows that 43 percent of scores lie in 11-15 class interval, 33 percent scores lie in 16-20 class interval, 5 percent score lie in 0-5 class interval and 10 percent score lies in two class intervals 6-10 and 21-25, respectively. This pie- chart shows that the maximum distribution of score lies in the interval 11 to 15.

Figure-2: Mathematics Achievement Score of Experimental Group



The pie chart on Mathematics scores of Experimental groups shows that 0 per cent scores lie in 0-5 and 6-10 class intervals, 3 per cent scores lie in 11-15 class interval, 5 percent scores lie in 16-20 class interval, 16 percent scores lie in 21-25, 45 percent scores lie in 25-30 class interval and 31 percent scores lie 35-40 class interval. This pie-chart shows that the maximum distribution of scores lies in the interval 25 to 30. This shows the huge effectiveness of the PowerPoint programme on experimental groups.

Table-2: Significance of Differences Between Mean, Standard Deviation and T-Value of Post- Mathematics Achievement Scores of Experimental Group and Control group

Groups	N	Mean	Std. Deviation	t-value
Control MATS	40	15.05	4.987	12.71
Experimental MATS	40	28.60	5.163	

Students of the experimental group showed a marvellous improvement in the post-test scores after the treatment. The calculated t- value was 12.71 which is more than the table value at 0.01 level of significance. It exhibits a significant difference between the mean post-test scores of the experimental and control groups. Findings of the study depicted that post-test mean scores are higher in the experimental group. Results indicated that the experimental group achieved higher mean gain scores (28.6) than the control group (15.05) in the post-test stage. Thus, the subjects exposed to ICT gained higher scores in comparison to that in traditional methods. In other words, ICT is found to be more effective in increasing the achievement expectation of IX class students. It means ICT lays positive impacts on a student's achievement. Researchers found that teaching with visuals strengthens students' cognitive skills. ICT encourages pupils' creativity and scientific thinking. It happens as a result of a deeper comprehension of the subject matter or the ability to complete more exercises in place of manually answering arithmetic problems. That suggests in some sense how learning performs differently under novel settings. Students recognized ICT as a tool for learning as well as one that can make a lesson more interesting. Students generally approve of it and

find it to be more useful. Additionally, it lessens individual variances and makes all students capable of succeeding. These results support other earlier findings with different populations and different subject areas.

This result is also supported by the views of Fuchs and Wosesman, 2004; Gunbas, 2015; Kanive, Nelson, Burns, &Ysseldyke, 2014; McLaren, Adams, Mayer, & Forlizzi, 2017 who reported a positive relationship between ICT use and mathematics achievement based on analysis of data. The study concluded that ICT had a positive impact on students' learning, critical thinking, and mathematics achievement. According to the various research, it is a dynamic approach and should be adopted for different types of students in schools. Whitaker, 2007 found that teaching math via online technology with video helps to improve students' academic performance. The adoption of technology facilitates new reforms in mathematics, which focuses on mathematical processes by offering quick and accurate computations as well as dynamic visuals as found in geometry and graphs. It makes the learning process enjoyable which improves students' performance apart from being fruitful by increasing the student's retention of information and methods. It helps in sparring more time for students and teachers to pursue the mathematical practices and operations in the classroom leading to fostering and imparting an immense understanding of mathematical concepts and enhancing capabilities and creativity to deal with more advanced mathematical content than in 'traditional' teaching environments.

Conclusion

Achievement is a behavioural change that occurs due to multifarious learning experiences. Analysis and interpretation of the results discussed above have revealed that ICT-enabled programmes prepared by the researcher show an immense impact on better learning of Mathematics. The Mathematics achievement of students can be increased by using these types of programmes. Students were motivated and interestingly participated in ICT-enabled programmes. Mathematics students were active during experiment work due to the uniqueness of the programme. The learning material of the Programme was more interesting, creative, valid, and effective rather than the traditional method of teaching. It included animation, text, graph, audio, figure, and video. It brought a new kind of experience for the students. It was expected that the outcomes can aid the students, teachers, school administrators, Government etc. and can act as a guide in the implications of the ICT enabled Programme in the different schools. The main goal of education can only be achieved by paying serious attention and addressing challenges related to ICT appropriately.

References

Aristovnik, A. (2012). *The impact of ICT on educational performance and its efficiency in selected EU and OECD countries: a non-parametric analysis. Available at SSRN 2187482*.

Bature, I. J., &Atweh, B. (2016). *Achieving quality mathematics classroom instruction through productive pedagogies. International Journal of Educational Methodology*, 2(1), 1-18.

Bloxham, S., & Slight, A. (2005). *Embedding personal development planning into the social sciences. LATISS: Learning and Teaching in the Social Sciences*, 2(3), 191-206. https://insight.cumbria.ac.uk/id/eprint/295

Bora et.al(2018) *Fusion of Ict In Mathematics Learning To Improve Secondary School, International Journal of Scientific Research and Reviews*,7(4) pp.96-111.

Gunbas(2015) *Students' mathematics word problem-solving achievement in a computer-based story Journal of Computer Assisted Learning*, 31 (1) (2015), pp. 78-95,http://www.wiley.com/WileyCDA

Ishaq, H., Shah, S. A., Muqaddar, L., &Tufail, M. (2021). *Effect Of Information Communication Technology (Ict) On Students' Motivation and Their Academic Achievement at University Level. International Journal of Management* (IJM), 12(1). http://www.iaeme.com/ijm/issues

Kanive, R., Nelson, P. M., Burns, M. K., &Ysseldyke, J. (2014). *Comparison of the effects of computer-based practice and conceptual understanding interventions on mathematics fact retention and generalization. The Journal of Educational Research,* 107(2), 83-89,https://www.tandfonline.com/doi/abs

Kazakov, S., Ruiz-Alba, J. L., & Muñoz, M. M. (2020). *The impact of information and communication technology and internal market orientation blending on organisational performance in small and medium enterprises. European Journal of Management and Business Economics*.

Kellar, M., MacKay, B., Zhang, R., Watters, C., Kaufman, D., &Borwein, J. (2003, March). *Architecture to support dynamic composition of Math lesson plans. In Proceedings of the 2003 ACM symposium on Applied computing* (pp. 569-574).https://doi.org/10.1145/952532.952645

Levin, T., &Wadmany, R. (2005). *Changes in educational beliefs and classroom practices of teachers and students in rich technology-based classrooms [1]. Technology, Pedagogy and Education*, Vol. 14, No. 3, 2005, 14(3), 281-307.https://doi.org/10.1080/14759390500200208

Mandal, A., Ghosh, A., Sengupta, G., Bera, T., Das, N., & Mukherjee, S. (2012). *Factors affecting the performance of undergraduate medical students: a perspective. Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine*, 37(2), 126-129.https://www.ijcm.org.in/text.asp

McLaren, B. M., Adams, D. M., Mayer, R. E., &Forlizzi, J. (2017*). A computer-based game that promotes mathematics learning more than a conventional approach. International Journal of Game-Based Learning* (IJGBL), 7(1), 36-56.https://www.cs.cmu.edu

Song, H. D., & Kang, T. (2012). *Evaluating the Impacts of ICT Use: A Multi-Level Analysis with Hierarchical Linear Modeling. Turkish Online Journal of Educational Technology-TOJET*, 11(4), 132-140.https://ideas.repec.org/p/ces/ceswps

Sosin, K., Lecha, B. J., Agarwal, R., Bartlett, R. L., & Daniel, J. I. (2004). *Efficiency in the use of technology in economic education: Some preliminary results. American Economic Review*, 94(2), 253-258.

Stuart, L. H., Mills, A. M., & Remus, U. (2009). *School leaders, ICT competence and championing innovations. Computers & Education,* 53(3), 733-741.

Zakaria, N. A., & Khalid, F. (2016). *The benefits and constraints of the use of information and communication technology (ICT) in teaching mathematics. Creative Education*, 7(11), 1537-1544. https://doi.org