The Impact of Educational Technology for Teaching Learning Process of Mathematics at Junior Secondary Level

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Abstract

With the global COVID-19 pandemic, terms such as digital education, online learning, and blended learning have grown unprecedentedly. The majority of educational institutions diverted their educational practices to new emerging technologies. Thus, integrating educational technological tools, theories, and practices in teaching and learning has recently gained considerable attention. Though many studies have been done on technological integration into teaching and learning, there is a dearth of studies done to examine how educational technology can be integrated into enhancing education achievement. This study, specifically, investigated the use of educational technology in enhancing mathematics achievement at the junior secondary level. Mathematics has been identified as a difficult subject, and most students are fed up with the subject. As a subject of developing analytical and logical thinking, mathematics is an important area to be studied. The study adopted a mixed methods research methodology. The study participants were seventy (70) students and sixteen (16) teachers from Galle Division. Two separate questionnaires with open-ended questions were administered with randomly selected participants, and data were collected. The opinions of students and teachers were examined. The findings revealed a lack of interest in the subject of mathematics, students unable to understand some mathematical concepts because of the instructor's lack of pedagogical knowledge, teachers not capable of teaching geometrical concepts, teachers not marking students' exercises, students thinking that tuition teacher is good than the school teacher, and, instructors are using only the textbook to deliver instructions, do not prefer the way teachers are teaching are as issues with the subject of mathematics. However, it was found that they are more interested in the subject if teachers are using educational technological tools during the teaching-learning process. Furthermore, most teachers identified that educational technology can enhance mathematics achievement. However, they mentioned the need for more skills in integrating new technologies into the teaching and learning process. This study suggests that there should be a system in education for developing teachers and students to use innovative education technological ideas in the teaching-learning process. Increasing teachers' awareness of the integration of the TPACK model is suggested.

Keywords: *Mathematics, educational technology, mathematics achievement*

Introduction

Technology has become integral to modern education, incorporating various methods, techniques, and approaches in teaching-learning (Mdhlalose & Mlambo, 2023). Even though digital development is ongoing, teachers must be convinced to use educational technology in their classrooms (Karunanayaka & Weerakoon, 2020). Using technological tools in the teaching-learning process enhances students' motivation, engagement and participation in learning. NCTM (National Council of Teaching Mathematics) has recognised the importance of using educational technology in mathematics education. Moreover, NCTM identified that using technology could improve teachers' instructional quality and students' mathematics learning, which ultimately assists in achieving equity in math education. There is no need to read or cram in mathematics, but one needs to practice more. This nature of mathematics facilitates teachers' use of technology in teaching and learning mathematics.

According to AECT, Educational Technology is defined as "the ethical study and application of theory, research, and practices to advance knowledge, improve learning and performance, and empower learners through strategic design, management, implementation, and evaluation of learning experiences and environments using appropriate processes and resources." Educational Technology is related to tools or materials and encompasses theories and practices. Mathematics education focuses on developing a person's analytical and problem-solving skills (Wijesundera, 2021).

Bray and Tangney (2017) emphasized that despite a significant body of research relating to technology-enhanced mathematics education, in the Sri Lankan context, there is a dearth of studies on to what extent educational technology tools are being used in math education. Integrating technology today is not an option; it is an essential part of the teaching-learning process. Moreover, the other important thing is that there is a lack of studies on the impact of educational technology on the teaching-learning process, even though there are significant amounts of studies on the impact of technology on the teaching-learning process. There is a difference between educational technology in education and technology integration into education (Lane, 2023).

The TPACK model, developed by Mishra and Koehler, researchers from Michigan State University in the late 1990s, is a widely accepted model that can be integrated into the teaching-learning process (Irwanto, 2021). This model demonstrates the interaction between technology, pedagogy, and content in instructional design. A teacher should have these three types of knowledge to give students meaningful experiences.

Thus, a need to study how educational and technological tools, materials, theories and practices are integrated into the teaching-learning process. Most students do not like to learn mathematics as they are considered as difficult as the subject of mathematics. The percentage of students passing mathematics and science in G.C.E O/L has been low over the past years (Amina et al.,

2023). In this study, the researcher aims to use educational and technological tools to overcome these problems and enhance mathematics achievement. And also, to determine to which extent educational technology is used in the classroom. This study aims to investigate to what extent education technological tools are being integrated into junior secondary classrooms in the Galle zone.

To identify issues in mathematics achievement.

To examine the knowledge of various ways of using educational technology.

To identify Perceptions of teachers of using educational technology for mathematics

Methodology

The research methodology used for this study incorporated a mixed methods approach, combining quantitative and qualitative data collection methods. This approach was chosen to comprehensively investigate the current issues of mathematics education, teachers' knowledge of various ways to use educational technology and teachers› Perceptions of using educational technology for mathematics schools in the Galle division.

Mixed methodology offers a holistic view of the complex relationships between technology tools and classroom outcomes. It allows the triangulation of findings and validates or challenges quantitative results through qualitative insights. This approach goes beyond statistical effects to uncover subtle contextual factors that influence educational technology use and provides a deeper understanding of the research topic.

This research study employed the mixed research paradigm, combining qualitative and quantitative research designs. Two separate questionnaires (for students and teachers) were used, with both closed and open questions. Moreover, the researcher observed mathematics lessons.

In this study, the random sampling method was used. The student sample included 70 students studying Mathematics studies in grades 6,7,8 and 9, classes representing the Galle division. Furthermore, a sample of 16 teachers who are teaching the subject of mathematics was selected for study following the same procedure. The questionnaires designed for students and teachers comprised basic information, and respondents' answers were classified under several areas, and the Likert scale was used to measure the statements. Furthermore, open-ended questions were given to express their views on using technical tools in various aspects of learning, and suggestions were made for improving the effectiveness of the learning-teaching process.

The qualitative data gathered using the abovementioned instruments were analyzed using descriptive methods, percentages, and SPSS data analysis. Responses were carefully examined to identify learners' and teachers' perceptions. Moreover, the notes made during the lessons' observations were also examined. The data were then coded to identify patterns and similar

categories. On the other hand, the quantitative data collected were statistically analysed and represented in the form of tables, charts, and/or graphs.

Finally, conclusions were drawn from the data to answer the research questions. The data were then coded to identify patterns and similar categories. On the other hand, the quantitative data collected were statistically analysed and represented in the form of tables, charts, and/or graphs.

Results and discussion

Issues of mathematics achievement

Students' interest in mathematics

Table 1

Students' interest in mathematics

responses	No; of students	Percentage (%)
Most interest	9	13%
Somewhat interest	10	14%
Neither interest or nor	20	29%
No interest	5	7%
Fed up with mathematics	26	37%

Only 19% of students in the sample strongly agreed with the statement about their interest in mathematics. Fourteen percent (14%), however, somewhat agreed with the statement, with 20% not agreeing or disagreeing. The other 7% showed no interest, and a significant number thirty-seven percent (37) were fed up with mathematics.

1. Parents' motivation for mathematics exercises at home
2. Students' interest in the way of mathematics teaching
3. Students' interest in providing instructions using technological tools such as computers

Table 2

Identify issues with mathematics

statement	yes	%	no	%
Parents' motivation for mathematics exercises at home	53	75%	17	25%
Students' interest in the way of mathematics teaching	23	33%	47	67%
Students' interest in providing instructions using technological tools such as computers	65	92%	5	8%

The above table shows that 75% of the sample says that they are motivated by parents to do mathematics exercises at home. Twenty-five per cent (25%) say that they are not motivated by their parents. Regarding the students' perception of how teachers teach mathematics, only 33% per cent of the sample are interested in the way of teaching. 47% are not interested in teaching mathematics. Ninety-two per cent of the participants are interested in providing instructions using technological tools. Only 8% of the sample is not interested in providing instructions using technological tools such as computers. Students are very interested in using various teaching methods in the teaching-learning process without being monotonous.

The above table shows that most students (67%) in the sample are not interested in teaching mathematics. Students have supplied a range of reasons for that, such as students being unable to understand some mathematical concepts because of the instructor's lack of pedagogical knowledge, teachers not being capable of teaching geometric concepts, teachers not marking students' exercises, students thinking that the tuition teacher is better than the school teacher, and instructors using only the textbook to deliver instructions.

Knowledge of Various ways of using educational technology

Students were asked what educational technological tools they used in the classroom. Only eight students (11%) responded that they use the smart boards in mathematics learning, and 12 (17%) responded that teachers rarely use computers. Unfortunately, all participants noted that no technological tools are used in teaching-learning. It was noted that students are not aware of educational technology. All participants think that smart boards, computers, and calculators are only about educational technology. Then, teachers were also asked how they could integrate

educational technology into the teaching-learning process. The researcher wanted to know, "Do instructors know educational and technological tools?". Instructors of the sample have provided a range of educational and technological tools such as calculators, boards, charts, graphs, and computers. All of them have mentioned physical tools. Those types of physical tools are only one aspect of educational technology. Collier (1990) stated in the book "What is Educational Technology" that educational technology is as comprehensive as education itself; it is concerned with not only electronic gadgetry but also with the design and evaluation of curriculum and learning experiences and the problem of implementing and renovating them.

Perceptions of teachers' of using educational technology for mathematics

Table 3

Perceptions of teachers' of using educational technology for mathematics

	statement	Agree and SA	%
1	Educational technologies engage learners' attention and motivate them.	13	82
2	Educational technologies improve learners' test and exam results.	15	94
3	Educational technology stimulates learners' curiosity	12	75
4	Educational technologies encourage learners to develop their problem-solving strategies.	10	63
6	Educational technologies improve the teachers' efficiency.	14	88
7	Educational technology provides teachers' approach and understanding of teaching.	12	75
8	Educational technology support for cooperative learning.	08	50
9	Technology-assisted instruction is more effective than the traditional methods of instruction.	11	69
10	Increases academic achievement.	12	75
11	Result in neglecting important traditional learning resources.	08	50
12	I believe I can implement Edu: tech: it successfully in the classroom.	02	13
13	Promotes student collaboration.	13	82
14	Makes classroom management more successful.	12	75
15	Promotes the development of communication skills.	13	82
16	Enhance my professional development	14	88
17	Eases the pressure on me as a teacher	04	26

The table depicts that higher percentages of mathematics teachers in the Galle zone agreed or strongly agreed with all the statements except statements 12 and 26. A few percentages were there, neither agreeing nor disagreed, disagreed and strongly disagreed. It shows that only 13%

agreed that they can successfully implement educational technology in the classroom. Also, a few teachers (26%) agreed or disagreed with the statement, easing the pressure on me as a teacher. According to the above table, teachers' perceptions about educational technology in teaching-learning are high. However, they feel they lack the skills to use these technologies and find them difficult.

Conclusions

In conclusion, it can be identified that there are issues in mathematics education, such as they do not have an interest in the subject and do not prefer the way teachers teach. However, it was found that they are more interested in the subject if teachers are using educational technological tools during the teaching-learning process. The interview questions for students and teachers were asked to know whether students and teachers are aware of what educational technology is and its use; it can be concluded that all the students and most teachers think that it is only about the tools. So, there should be a system to make teachers and students aware of educational technology and the ways of using it. When considering the perception of using educational technology, they perceive that innovatively using it is a good path to keep students' interest in the subject well and improve their achievement level. However, they feel they lack the skill to use innovative educational technology in teaching-learning.

From the administrator's and policy makers' side, it should be emphasised more on developing the skills of using educational technology in teaching-learning. Even though teachers are currently using primary methods of educational technology, they should have more awareness of new methods that can be integrated. Then, not only mathematics, STEAM education can be developed through teaching. In this regard, in-service and pre-service teachers' development should be considered. Further research should be done to determine to what extent educational technology is being used in the schools in Sri Lanka, and action-based, or DBR should be conducted to develop innovative ideas to establish a system to provide a sound understanding of educational technology and its uses.

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