

# Opportunities of ICT as Integrated Approach in Classroom Practice

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## ABSTRACT

*This paper aimed to motivate teachers and students to use information and technology (ICT) as an integrated approach to teaching mathematics. This article is prepared regarding the research question, "Why use ICTs in the classroom?" The research design of this study was qualitative. Two teachers and two students of the Bachelor of Business Management (BBM) third semester from two different colleges were the research sample, whereas the sampling was purposive. An in-depth interview and classroom observation of participants were the data collection methods, whereas the data collection tool was interview guidelines for both teachers and students. Teachers and students have to use ICTs in the classroom because it increases students' engagement and motivates them to learn. ICTs provide the opportunity for self-learning, teaching-learning and earning, student and teacher interaction, and create a student-friendly learning environment. So, teachers and students have to use ICTs in the classroom. This research is also recommended to policymakers, curriculum designers, educational institutions, teachers, and students to use the findings of this research to develop plans, curricula, infrastructure, environment, and learning behaviors that support ICT use. By doing so, education can be made more effective and engaging for all involved.*

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**Key Words:** ICT, Opportunities, Mathematics classroom, F2F, Engagement, ZPD

## Introduction

The United Nations Educational, Scientific, and Cultural Organization [UNESCO] (2002), defines information technology as a scientific, technical, and managerial discipline and methodology used in the handling of information, its application, and its link with social, economic, and cultural concerns. According to Prytherch (2000), ICTs are networks that open up new possibilities for teaching, learning, and training through the distribution of digital content.

Globally, many plans and policies exist to enhance the use of ICTs in teaching-learning. United States National Education Technology Plan (NETP) (2021) addressed

the infrastructure needs to make the vision a reality, and the vision was to insert ICTs in schools across the nation. Similarly, the policy objective of the Department of School Education and Literacy Ministry of Human Resource Development Government of India (2012) was to create an environment that is favorable to the development of an ICTs-literate community that is also conducive to the formation of a demand for the best possible use of and returns on the potentials of ICTs in education. Likewise, at the beginning of each year in Montenegro, the Ministry of Education creates an action plan for carrying out the recommendations made in the strategy on the use of ICTS in education, and at the end of each year, the Ministry submits a report to the Government (Eurydice, 2019).

There are many plans and policies to accelerate the use of ICTs in teaching-learning. The National Center for Educational Development [NCED] (2005) has conducted a variety of teacher training programs to improve the teachers' ICT skills so they can use them to teach and study. Similarly, the Nepalese Ministry of Education [MoE] (2017) has launched a master plan for information and communication technology (ICT) in education, intending to ensure ICT use across the country.

There are many plans and policies at both national and global levels. This study was to motivate teachers and students to integrate ICTs in the classroom by investigating the opportunities. So, the research question of this study was "Why use ICTs in the classroom?"

Das (2019) carried out research entitled "Role of ICT for Better Mathematics Teaching" with the primary goal of investigating the use of ICT technologies in mathematics education and found that ICTs integration in mathematics education benefits both the teaching and learning processes. Technology offers exciting new ways to teach (Scharaldi, 2020). According to (Barboni, 2019), the importance of the face-to-face (F2F) instruction method cannot be reduced, but e-learning can be used together with the traditional methods to bring efficiency, effectiveness, and a competitive edge over other competitors by imparting quality education.

Most of the ICT-related research was on online teaching-learning. There was a lack of ICT research for the F2F mode. This research was focused on the use of ICTs in both F2F and online teaching-learning, that is blended mode. In the context of Nepal, there is a lack of research on the use of ICTs in teaching-learning activities, especially in mathematics. Some researchers found opportunities for the use of ICTs for online classrooms quantitatively from the positivist perspective. This research was focused on investigating the opportunities created by ICT integration in the classroom qualitatively.

### **Research Methodology**

Qualitative research is considered a naturalistic inquiry in the sense that it is performed in a natural context while attempting to avoid any intentional manipulation and distortion of the informants' surroundings by the researcher (Tames, Stigler & Perry, 1998; as cited in Creswell, 2007). The research design was qualitative. Data were collected from two students and two teachers from two different colleges. One teacher and one student were selected from each college. So two colleges were the site, whereas two teachers and two students were my samples. This research used pseudonyms C1 and C2 for colleges, S1 and S2 for two students, and T1 and T2 for two teachers. S1 and S2 were the students of BBM's first and third semesters respectively. S1 and T1 were respectively students and teachers of college C1 whereas S2 and T2 were the student and teacher of college C2. The sampling of my research was purposive. The data collection method was an in-depth interview, whereas the data collection tools were interview guidelines. Data were analyzed by the general inductive method. Translating, transcribing, coding, theme-making, and linking with theories (Thomas, 2006) were the steps of data analysis. The social constructivism theory of Vygotsky (1978) and the connectivism theory of Downes (2007) were integrated into this research.

### **Results and Discussion**

This study explored various opportunities for ICT-integrated mathematics classrooms and included a detailed analysis of opportunities created by ICT integration in the classroom. Some themes were developed to describe the opportunities created by ICT-integrated classrooms. Students' engagement, excavation of ZPD (Vygotsky, 1978), Reduced time and cost of learning, the student-friendly atmosphere in the classroom, and the opportunity of teaching, learning, and earning are the themes under which the opportunity of ICTs' integration in the classroom was analyzed. These are the causes to promote the use of ICTs in the classroom.

#### **Students' Engagement**

Student engagement is the level of focus, curiosity, enthusiasm, glee, and energy that students exhibit when learning. When a student is engaged, they are taking part in educationally beneficial activities both inside and outside of the classroom. It involves the kids' cognitive and non-cognitive activities. It is one of the most crucial elements for successful teaching-learning. Since it takes into account a student's level of focus, effort, good feelings, and commitment to the learning process, student engagement is essential. (Handelsman et al., 2005).

In this issue, one of the teacher participants, T1 conveyed her view as,

*Students become engaged in ICT-based learning by asking questions and solving problems. They solve problems using ICT applications such as Google, YouTube, and other applications. They compute addition, multiplication, mean, median, mode, standard deviation, correlation, and probability distributions by using MS-excel. Sometimes I ask them to prepare a report on a different issue. They prepare by using MS-word. They attach different pictures, graphs, and diagrams from different applications or websites. They present their work by using MS PowerPoint. No one wants to leave the class. They talk and teach each other to prepare the report and to solve the different problems. ((Interview transcription January 12, 2023).*

From the interview with the teacher, it was found that students engage with ICT-based learning by using ICT apps such as Google, YouTube, and other applications to ask questions and solve issues. They use MS-office to create reports, attach photos, graphs, and diagrams, and present their work. They discuss and instruct each other how to produce the report and solve the problems. So, the Use of ICTs in teaching learning increases the students' engagement.

One of the student participants, S1 shared his view,

*Our teacher sometimes teaches mathematics through ICTs. We feel happy and enjoy learning mathematics by using ICT tools. Sometimes our teacher teaches mathematics in the ICT lab, and sometimes he teaches in our class using a projector. While learning in the ICT lab, we use laptops, desktops, and tablets. At that time, we tried to solve a problem on laptops, desktops, and tablets as per the instruction of our teacher. We also watch YouTube videos and Google search engines and also use various types of apps to solve problems. He added that they talk digitally and send the solutions to each other. We become able to find the solution to the same problems in different methods. While their teacher teaches in the classroom, by using a Projector, they become focused and learn the concepts. We became engaged more in the ICT lab rather than in the classroom (Interview transcription January 22, 2023).*

According to the student interview, the teacher sometimes teaches using ICTs at the ICT lab. Students use laptops, desktop computers, and tablets to tackle difficulties at the time. They also use content from YouTube, Google search engines, and numerous apps to address difficulties. They become more engaged in the ICT lab rather than in the classroom. ICTs increase collaboration among learners and encourage communication and knowledge sharing, provide quick and accurate feedback to learners, which leads to positive motivation, and allow pupils to focus on strategies and interpretations of answers rather than disputing (Becta, 2003).

ICTs encourage students to be more engaged and participative (Dhakal & Sharma, 2016). Three sorts of student engagements were detected. They were students' engagement with teachers, engagement among students, and engagement with digital technologies. Students' engagement with the instructor involves their interests, motives, and other concentrated activities stated in front of the teacher. It also includes student interaction with the teacher. Among Students' engagement involves an appearance of stubbornness among them. It refers to actions designed to increase pupils' motivation to study. According to Akpan, Igwe, Mpamah, and Okoro (2020), social constructivism is a collaborative method of learning that focuses on interaction, debate, and knowledge exchange among learners. Students are constructing knowledge by accelerating engagement in learning through ICTs. High levels of engagement, according to Heick (2022), are characterized by tenacity, protracted inquiry, self-directedness, playfulness with material, and unprompted transmission of information. Students are more engaged when lessons are taught by using ICTs.

### **Excavation of the ZPD**

Vygotsky (1978), introduced the Zone of proximal development (ZPD) and defined it as the gap between what a learner has already mastered (actual degree of development) and what he or she can gain when furnished with educational assistance (potential development). ICT integration in teaching-learning helps one to understand what he/she wants.

If one wants to learn more complicated concepts, then he/she can get the content and more tools on ICTs. In this issue, one of my teacher participants, T2 conveyed his view as

*I think knowledge was captured in the past, but now it has been exposed due to ICTs. I have been teaching for several years. I used to teach only the contents which are given in the book. I used to solve the questions by the methods which were shown in the examples of the book. After using ICT tools, I can find a lot of materials related to the course content. I can show several methods of solving problems. Similarly, I can teach the syllabus of the upper class. I can get a lot of materials by which I can strengthen the capabilities of my students. I can teach content to the extent that they can understand (Interview transcription February 01, 2023)*

From the interview, it was found that teachers are filling the ZPD of students through ICT integration in the classroom. Teachers are teaching some extra content and the content of the upper class in the classroom through which the ZPD of students is being filled. The availability of contents, materials, and easiness of using ICT is making it easy to teach, and students are learning more and filling their ZPD.

Similarly, one of the student participants, S2 conveyed her view,

*One of the students said "When our teacher uses ICT tools to teach us, we become very excited. We understand the concept by ICT tools rather than the traditional lecture method. We can see and analyze ourselves. After understanding the concept we can easily derive the related formulae and solve the problem. Sometimes we don't need our teacher's help within a whole chapter." (Interview transcription February 11, 2023)*

*He added "Our teacher always informs us what he is going to teach tomorrow. I always prepare that chapter before our teacher teaches. For this, I searched on YouTube for the concept and then started to do it myself. I asked the teacher what I didn't understand. So that learning mathematics has been easier than the previous days." I am in BBS first year but I am preparing for the course of BBM second and third year for this ICT is helping me. I searched the contents of BBM's second and third semesters on the internet and tried to understand them. If I can't, I contact my teacher and ask a lot of questions. Sometimes our teachers give the different websites from where I can learn. (Interview transcription February 11, 2023)*

From the above interview, it was found that ICT is providing opportunities for self-learning to students. Students are preparing a lot through ICTs. Students are also preparing the content for upcoming both horizontal and vertical classes. Their teachers are also providing them with the address of the knowledge on the internet. Students are developing both horizontal and vertical knowledge through ICTs. It means because of the availability of lots of content and learning materials students are filling their ZPD through ICTs. Students' self-learning, teachers' efforts, and use of ICTs are filling the ZPD of students.

Students who are digging ZPD by using ICTs in three ways. First students are learning horizontal content and expanding their knowledge, second students are learning horizontal content and enhancing their knowledge, and third students are learning new content and enriching their knowledge.

### **Reduced Time and Cost of Learning**

Integration of ICT in mathematics saves time and money (Sah, 2023). Students may study quickly and at leisure because of ICTs. They can learn everything they need to know using ICTs for free. When participant student S1 was asked the question how ICTs save his time and money? he replied as,

*We save time by using ICTs. We can fix the problem and get a response in a matter of minutes. We may watch videos and search Google for relevant solutions to problems or concepts. We are not required to visit the teacher. We are not required to pay for tuition and additional fees. This approach saves both time as well as cash (Interview transcription January 12, 2023)*



ICT saves both time and money. By taking advantage of this opportunity, students can focus on their studies and gain valuable experience without worrying about financial burdens. This can ultimately lead to greater success in their academic and professional pursuits. While discussing this issue, one of my teacher participants T2 expressed her opinion,

*I used to spend roughly an hour every day planning lesson ideas for teaching. I still use the ICT tools from a year ago. I spent a bit more time preparing resources to teach the prior year, but I am currently utilizing those materials that were created. In a lesson, I can display several slides. I can teach more effectively if I use already prepared materials. It has saved me time. ICTs in mathematics teaching save time and money. We can make students show the problem of statistics in Excel. Students can draw simple bar diagrams, multiple bar diagrams, submultiple bar diagrams, pie charts, histograms, ogives, parabolas, hyperbolas, ellipses, circles, etc. in a few minutes. Students can solve lengthy mathematical problems in a short period. (Interview transcription February 01, 2023).*

ICTs in mathematics teaching have saved time and money by allowing students to draw bar diagrams, multiple bar diagrams, submultiple bar diagrams, pie charts, histograms, ogives, parabolas, hyperbolas, ellipses, circles, etc. in a few minutes. This has enabled students to solve lengthy mathematical problems in a short period.

Next teaching participant T1 stated, "I used to buy a lot of books to prepare, but now I use ICTs in mathematics learning." I can download enough books and prepare them by using several Google pages, YouTube, and other programs. As a result, it has reduced my learning costs. ICTs have reduced learning costs by allowing participants to download books and prepare using Google Pages, YouTube, and other programs. Teachers and students believe that the Use of ICTs in teaching-learning mathematics saves time and cost. The use of ICTs improves productivity while reducing costs and saving time (Anderson, 2022).

### **Student-Friendly Atmosphere in Classroom**

A pleasant classroom atmosphere is one in which students feel safe sharing their ideas, taking chances, asking questions, and tackling learning problems. The classroom environment is a synthesis of the class's social, emotional, and educational components. ICT integration in the classroom is helpful in creating a student-friendly environment (Sah, 2023). According to research, several components of the classroom environment can influence student motivation, and motivated students put more effort into learning activities (Ambrose et al., 2010). On this issue, my first student participant S1 expressed his view,

*Learning mathematics through ICTs provides an interesting, engaging, and joyful environment for us. We learn the concepts and problem-solving methods easily. We always feel fresh and energetic in the classroom. Our focus on learning increased, and it was very hard to complete the project work given by the teacher in previous days. However, after using ICT in the mathematics classroom, it has been quite easy to complete. Our teacher gives us project work to complete, and he also gives us the chance to use the internet in the classroom. We, students, use the internet and try to find information related to our project work. We collaborate. We also discuss our curiosity related to our project work and try to find the best measures. It has enhanced our confidence level. We don't have any problem presenting our work in front of the classroom with the help of ICTs (Interview transcription January 22, 2023).*

Learning mathematics through ICTs provides students an interesting, engaging, and joyful environment. They easily learn concepts and problem-solving methods, and their focus on learning increases. They use the internet to find information related to their project work, collaborate, discuss their curiosity, and find the best measures. This has enhanced their confidence level and they don't have any problem presenting their work in front of the classroom.

Teacher participant T2 articulated as,

*When I use ICTs to teach mathematics in the classroom, students become active. They use ICT tools themselves. They open the ICT tools and start to search for what we have to learn. While we use ICTs, we learn from a wider perspective. They digitally communicate with each other. They complete their project on time. ICTs decrease my role while increasing students' engagement. Students used to complain about my teaching strategy. They used to say that my classroom was not collaborative. But now and then I take them to the ICT lab to teach mathematics. They don't have any complaints about my teaching strategy. Relation between us has been improved. So, I can say that teaching mathematics through ICTs in the classroom creates a friendly atmosphere for students (Interview transcription, February 01, 2023).*

From the interviews, it was found that teaching mathematics through ICTs can create a student-friendly environment in the classroom. It is helpful to create a positive atmosphere in the classroom. It boosts the student's confidence level and is very helpful to fulfill the student's curiosity.

Students enjoy the learning process and the teacher's duty is changed as a mentor. Akpan, Igwe, Mpamah, and Okoro (2020) explain constructivist theory deemphasizes teacher monotony in the classroom and encourages energetic interplay among learners, the instructor, and other components of the educating learning process. I found ICTs helpful in creating a student-friendly learning environment. Both the instructor and the



student agreed that an ICTS-friendly learning environment fosters more collaborative and supportive behavioral habits in the classroom (Mishra, 2020).

### **The opportunity of Teaching, Learning, and Earning**

Schools can do to improve learners' learning and earning potential (Mayer & Peterson, 1999). Teaching, learning, and earning at the same time can motivate teachers to teach and students to learn. Many pieces of research show that learning and earning have the same importance in our life. ICT integration can simultaneously create opportunities for teaching, learning, and earning (Sah, 2023). In this issue, one of my teacher participants T1 expressed his view as,

*I run a page on Facebook called GyanMaitri. I frequently post the lessons I've taught in class. The crucial test questions also are uploaded by me. 122 flowers may be viewed on my page. The most views I've ever received on a page were 799. Additionally, I run the GyanMaitri YouTube channel. I'll publish videos with mathematical content. I will monetize both my Facebook page and YouTube channel once I get a sufficient number of subscribers and followers. This will provide me with the chance to study and make money at the same time (Interview transcribed, January 12, 2023).*

Monetizing social media accounts is a popular way for content creators to earn money and gain exposure. By utilizing this strategy, teachers can create a sustainable income stream while also building their brand and developing their skills as content creators.

Student participant S1 conveyed his view as,

*Since I blog, I post videos to my blogs. I'm willing to record the classroom if given the chance. I may edit it and post it after making it live. I am capable of video editing. I believe we could easily get enough followers if we had a channel dedicated to mathematical topics. Once we have a sufficient number of subscribers, we can start making money (Interview transcribed, January 22, 2023).*

Some of the students are capable of video editing and would be willing to record a classroom if given the chance. They believe we could easily get enough followers if we had a channel dedicated to mathematical topics and start making money.

It was discovered that they are aware of the possibility of teaching and learning simultaneously in an ICT-integrated mathematics classroom. In a similar vein, researcher learned through speaking with students that they are aware of the possibility of studying and earning at the same time with the use of ICT-integrated classrooms. Combining these two findings, it is concluded that an ICT-integrated mathematics classroom can offer the chance for teaching-learning (Tsui, 2001) and earning simultaneously. Numerous studies in Nepal have shown that salaries for teachers are insufficient. ICT-

based instruction can give instructors the chance to make money. That is, teachers and students, can connect (Downs, 2007) their teaching-learning to earning. It also concludes that although every teacher and student is aware of the possibility of teaching, learning, and earning simultaneously in an ICT-integrated mathematics classroom, relatively few are making use of this possibility.

### **Conclusion and Recommendation**

ICT integration in mathematics classrooms has created opportunities for both teachers and students. It has opened the door of knowledge and provided an enormous platform for both teachers and students. Teachers and students are using the ICTs of their choice (Sah, 2023). The traditional teaching-learning process is gradually shifting to ICT integration in teaching-learning. It is said that morning shows the day. Teaching through ICTs has created opportunities. Thus ICTs will open more windows of both teaching and learning. So, that teachers and students need to integrate ICTs in the classroom.

ICTs help students to be more involved and participatory in three ways: interaction with professors, engagement with students, and engagement with digital technology. Students' participation includes expressing their interests, motivations, and other actions in front of the teacher. Tenacity, persistent inquiry, self-directedness, playfulness with material, and unprompted conveyance of information are characteristics of high levels of engagement. Students are using ICTs to expand their knowledge, enhance their knowledge, and enrich their knowledge by learning horizontal content, enhancing horizontal content, and new content. They are digging ZPD with the help of ICTs. ICTs in mathematics teaching-learning have saved time and money by allowing students to solve their problems in a few minutes. They can download books and get access to free learning. Students like the learning process, and the teacher's role as a mentor is altered. I found that ICTs were useful in creating a student-friendly learning environment. An ICTS-friendly learning environment, both the teacher and the student agreed, encourages more collaborative and supportive behavioral patterns in the classroom.

ICT integration in the classroom created opportunities for student engagement, excavation of ZPD, Reducing time and cost of learning, the student-friendly atmosphere in the classroom, and the opportunity for teaching, learning, and earning are the themes under which this study analyzed the opportunity of ICTs' integration in the classroom. So we have to accelerate the use of ICTs in the classroom.

Teachers and students are both aware that they can teach and learn. ICT integration in teaching-learning can provide opportunities for both teaching-learning and earning at the same time. Numerous studies in Nepal have found that teacher pay is insufficient. Teachers can earn money through ICT-based exercises. Even though every teacher and

student is aware of the possibilities of teaching, learning, and earning at the same time in an ICT-integrated mathematics classroom, very few use it.

This research would be valuable for a wide range of individuals and organizations involved in education. Specifically, this study is recommended to policymakers, curriculum designers, schools, teachers, and students to use the findings of this research to the development of plans, curricula, infrastructure, environment, and learning behaviors that are supportive of ICT use. Doing so can make education more effective and engaging for all involved. Since ICTs have created opportunities each of the mathematics teachers of higher education have to integrate ICTs in the classroom.

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