OJED
OPEN JOURNALS IN EDUCATION

International Journal of
Multidisciplinary Perspectives in Higher Education
Volume 3, Issue 1 (2018)
https://www.ojed.org/jimphe
Print ISSN 2474-2546
Online ISSN 2474-2554)
10.5281/zenodo.2525831

Use of ICT Tools in Teaching Mathematics in Higher Education: A Case of Mid-Western University

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Abstract
Information and communication technologies (ICT) are an essential portion of teaching learning process. The article examines the use of the application of ICT tools in teaching mathematics and to identify the attitudes of teachers towards the use of ICT tools at Mid-Western University, Nepal. The result of the study indicated the positive attitudes of teachers along with the need of the use of the ICT tools for professional development of teachers and increase the performance of the learners as the learners were found motivated by the recent development of the tools. However, the lack of knowledge to integrate the tools, availability of the resources, affordability by the learners and insufficient teacher training provisions were found as the barriers in the use of the tools

Keywords: Information Communication Technology, learners' Knowledge, teaching, training, professional development.

The term "information and communication technologies" (ICT), refers to forms of technology that are used to transmit, store, create, share or exchange information. This broad definition of ICT includes such technologies as radio, television, video, telephone (both fixed line and mobile phones), satellite systems, computer and network hardware and software, as well as the equipment and services associated with these technologies, such as videoconferencing and electronic mail (Iahad, Shallsuku & Oye, 2012). ICT in education involves teaching and learning with ICT. Research has shown that ICT can lead to

improving students' learning and better teaching methods. In recent years new technology and computer and internet have affected dramatically all aspects of our society. Many traditional activities have become obsolete, while new professions and new challenges arise. For instance, technical drawing is no longer done by hand. Nowadays, instead, one uses commercial software, plotters, and other technological devices, many software for symbolic algebra are becoming widely available. Computers have also made it possible to construct "virtual realities" and to generate interactively animations or marvelous pictures. Moreover, electronic devices can be used to achieve experiences that in everyday life are either inaccessible or accessible only as a result of time-consuming and often tedious work.

Ittigson & Zewe (2003) cited that technology is essential in teaching and learning mathematics. ICT improves the way mathematics should be taught and enhances student understanding of basic concepts. Many researchers have carried out studies to evaluate the benefits of using ICT in mathematics. Becta (2003) summarized the key benefits – ICT promotes greater collaboration among students and encourages communication and the sharing of knowledge. ICT gives rapid and accurate feedback to students and this contributes towards positive motivation. It also allows them to focus on strategies and interpretations of answers rather than spend time on tedious computational calculations. ICT also supports constructivist pedagogy, wherein students use technology to explore and reach an understanding of mathematical concepts. This approach promotes higher order thinking and better problem-solving strategies which are in line with the recommendations forwarded by the National Council of Teachers of Mathematics (NCTM); students would then use technology to concentrate on problem-solving processes rather than on calculations related to the problems (Ittigson & Zewe, 2003).

For a successful integration of ICT into the mathematics curriculum, it is essential to have knowledge of the existing software that is used by mathematics teachers. Contemporary technologies, specifically information and communication technologies today are considered a key factor of quality education system success, especially because the educational process is based on the collection, processing,and presentation of information (Eisenberg, 2008). The education system has not changed fundamentally over 100 years and the usual way of teaching is still based on teachers presenting information to "passive" students (usually in the form of the so-called frontal instructions). Furthermore, it is considered that using contemporary technology is not a prerequisite for successful teaching. Information era students are considering teaching with the intensive use of technology as motivating and a necessity (Passey, Rogers, Machell, & McHugh, 2004). Therefore, students find teaching without the use of technology obsolete and boring. It is necessary to emphasize that technology does not solve all the problems of education and that the process of teaching can be very successful without the use of the same. In other words, technology cannot be used as a shortcut for knowledge and skills acquisition (Toyama, 2011).

Although some higher education institutions have the zeal to establish effective ICT education programs, they are faced with the great problems of proper implementation of the programs. Almost all developing countries like Nepal, basic ICT infrastructures are inadequate; a result of a lack of electricity to power the ICT materials and poor telecommunication facilities. Above all, this lack of access to infrastructure is the result of insufficient funds. Many cities and rural areas in Nepal still have fluctuation in their supply of electricity which makes the implementation of ICT in education most difficult. Furthermore, most Nepalese universities have access to basic instructional technology facilities, but difficulty to make the integration of instructional technology in the delivery of quality education because computer-related telecommunication facilities might not be very useful for most Nepalese students, as computers are still very much a luxury in institutions, offices, and homes. This has made the integration of essential online resources (e-mail, world-wide-web, etc.) into higher education most difficult. In higher education, an important aspect of the shift in technological processes has been to the acceptance and use of ICT for teaching and learning.

Objective of the study

The main objective of this study was to examine the use of ICT tools in mathematics teaching. The study aimed at identifying the most common ICT applications used by the teachers and how ICT was used in the classroom. It also aimed at understanding the attitude of teachers towards ICT tools.The barriers faced by teachers during the integration of ICT intomathematics lessons and their perception of the usefulness of an e-portal were also investigated.

Method

This study was quantitative in nature. The author used a survey method to investigate the use of ICT tools in mathematics teaching, the attitude of mathematics teachers towards ICT tools and the barriers of integrating ICT into the teaching of mathematics. The survey was conducted within the Central Campus of Mid-Western University, Nepal. Altogether 16 mathematics teachers of different five faculties were the population of this study. Among them, 8 teachers were selected as sample of the study using simple random sampling. Classroom observation was carried out to find the use of ICT tools in teaching mathematics. A structured interview was conducted to find the attitude of teachers towards ICT tools and the difficulties of integrating ICT tools in teaching mathematics. The interview schedule was divided into three areas, (a) how teachers use ICT tools, (b)teacher's attitude towards the use of ICT and (c) the barriers faced by teachers in using ICT tools.

Results and discussions

a. Application of ICT tools in general

Application of ICT tools covers the use of the different kinds of ICT tools that teachers use in their classroom as per the goals they set for their classroom.

Table1 Common ICT applications by teachers

Applications	**Daily (%)**	**Weekly (%)**	**Monthly (%)**	**1 or 2 times a year (%)**	**Not available (%)**	**Never (%)**
Computer	25	12.5	12.5	50	0	0
Projector	12.5	25	25	37.5	0	0
Presentation software	12.5	0	12.5	0	25	50
Graphical applications	12.5	0	12.5	12.5	25	37.5
Word package	12.5	25	0	0	37.5	25
SPSS	0	12.5	25	25	0	37.5
Android mobile apps	50	25	12.5	12.5	0	0

Table 1 shows that 25% of the respondents used computers on a regular basis. It also indicates the percentage of usage by teachers in the various ICT applications is : 12.5% of the respondent use projector and other ICT tools regularly and most of the teachers(37.5%) use occasionally. No teachers were found using any sorts of software applications in their classroom. These percentage shows that the use of Android mobile apps is 50 % because it is easier to access and with all students.

2. Use of e-mail and internet in the classroom

Use of e-mail and internet in the classroom is connected with virtual situations. Here the author focused to the sharing of materials and assignment along with graphical visualization with the significance of discussion forum.

Table:2 Use of e-mail and internet in the classroom

Application	**Always (%)**	**Sometimes (%)**	**Never (%)**
Online demo	12.5	50	37.5
You tube videos	12.5	75	12.5
Graphical visualization	12.5	50	37.5
Discussion forum	12.5	62.5	25
Chat room	25	37.5	37.5
Group message on messeng	25	75	0

According to table 2 , it was found that most of the teachers(62.5%) use regularly group messenger in teaching. Most of the teachers usethe online demo, chat roomyoutube videos, discussion forum,and chat room occasionally. The teachers were found aware with the virtual environment and sharing options, but they

couldn't apply as of the access and technological supports. On the other hand, they were found quite unaware in integrating the available sources for productive outcomes.

3.The attitude of teachers towards ICT tools

The attitude factor reflects the perception of teachers in the use of ICT tools in their pedagogical perspectives.

Table 3 Attitude of the teachers' towards ICT tools

In mathematics classroom	**Very useful and helpful (%)**	**Useful and helpful (%)**	**Not so useful and helpful(%)**	**Not at all(%)**
Computer	25	75	0	0
Projector	0	100	0	0
e-mail	25	75	0	0
Internet	37.5	62.5	0	0
SPSS	25	62.5	12.5	0
Mathematica& Geogebra	37.5	62.5	0	0

Table 3 indicates the attitude of teachers towards ICT tools in mathematics teaching at a higher level. It was found that all the teachers(100%) told that the projector is useful and helpful. 75% of them told that e-mail is useful and helpful. Most of the teachers (62.5%) told that the internet, SPSS, Mathematica & GeoGebra are useful and helpful in mathematics teaching at a higher level. It shows that all the teachers have given importance of ICT tools in teaching mathematics at a higher level.

4. Barriers faced by teachers in using ICT tools in Mathematics teaching

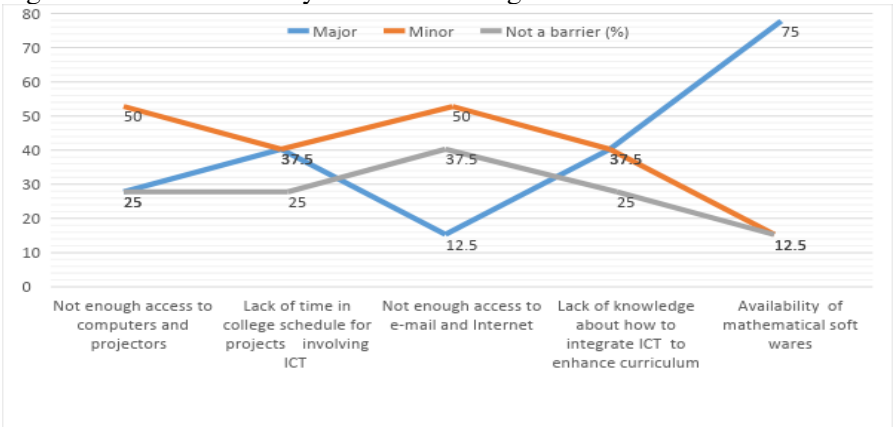
Barriers refer to the difficulties faced by teachers in certain issues in the value of applying the ICT tools as it is combined with professional ethics, motivational values, knowlede management factors, resource management and mobilty, integration of tools and affordabillity by learners.

Table: 4 Barriers faced by teachers in using ICT tools in Mathematics teaching

Barriers	Major (%)	Minor (%)	Not a barrier (%)
• Not enough access to computers and projectors	25	50	25
• Lack of time in college schedule for projects involving ICT	37.5	37.5	25
• Not enough access to e-mail and Internet	12.5	50	37.5
• Lack of knowledge about how to integrate ICT to enhance curriculum	37.5	37.5	25
• Availability of mathematical soft wares	75	12.5	12.5
• Lack of technical support for ICT tools	62.5	37.5	0
• Students do not have access to the necessary technology at home	87.5	12.5	0
• Teachers do not have access to the necessary technology at home	12.5	50	37.5
• Lack of training, seminar, workshop and talk program in ICT	100	0	0

From table 4, it is concluded that the major problem of teachers in using ICT tools in mathematics teaching at Mid-Western University is the lack of training, workshop,seminar and talk program in ICT. Similarly, another main barrier is that the students do not have access to necessary technology at their home. Availability of mathematical software, lack of technical support in ICT, lack of knowledge about how to integrate ICT in Mathematics teaching are the major barriers for teachers in using ICT tools in mathematics teaching in higher education. The following line graph shows clear figure of the barriers in the use of ICT tools.

Figure 1. Barriers faced by teachers in using ICT tools in Mathematics teaching



Discussion and Conclusion

Technology significantly affects the everyday life and, therefore, the teaching process. The tendency of ICT integration in teaching is unambiguous and there is a consensus on the importance of such integration. The research of the contemporary technology impact on the educational process has an important role in the integration process. This study tried to find out the use of ICT tools in mathematics teaching in Mid-Western University, Nepal. It also aimed to identify the attitude of teachers towards ICT tools and the actual barriers on using ICT tools regularly. It was found that all the teachers think ICT is useful and helpful in mathematics teaching in university level but major problem is that there is the lack of training and workshop for teachers to develop their technical capacity on mathematical software.

The use of ICT in teaching mathematics can make the teaching process more effective as well asenhance the students' capabilities in understanding basic concepts and logics . Nevertheless, implementing its use in teaching is not without problems as numerous barriers may arise. The types of barriers have been identified in the study.The case of ICT for education and for university undergraduates offering mathematics course, in particular, are more critical today than ever before since new means of improving instructional methods are triggering a change in the delivery of education. This paper confirms the response of university teachers in the role of ICT tools in mathematics teaching. The summary of the ICT usage shows that minority (12.5%) use technology regularly.Most of the teachers (50%) use android mobile apps.The majority of the respondents (100%) said that the greatest barrier to using ICT is the lack of training, seminar,and workshop for teachers in ICT tools. Lack of technical support is another main barrier. These major problems must be investigated by the university management. Recommendations were made, that the University should develop ICT policies and guidelines to support university teachers in their academic work and technology has been the major concern to the developed world as it is the emerging concern of the shrinking world as well as the practitioners who are looking for wider horizon of knowledge management.

In a nutshell, Pedagogical and content knowledge is fostering by technological knowledge in this 21st century and Technology should relate to logic development. I strongly recommend that the teachers of 21st century are dynamic and context sensitive rather to the content sensitive only and indeed they should develop oneself in the framework of 21st century skills.

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