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Practices of ICT in Teaching and Learning Mathematics

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Abstract

This study explores community and institutional teachers and students' practices of ICT tools inteaching and learning Mathematics. The data were collected by administrating questionnaire to 46 Mathematics teachers of secondaryschools and 146 students from 15 community and 8 institutional secondary schools of Okhaldhunga district using stratified random sampling method. To identify practices of Mathematics teachers and students in the use of ICT tools, five-point rating scale questionnaires were prepared on social media, online resources, mobile application and mathematical software. The data were tabulated and analyzed by using SPSS software version 21.0 to get the value of statistics chi-square test, percentage, mean and standard deviation and t- test. It was found that community and institutional secondary school's Mathematics teachers have no significant differences in practices of ICT tools in teaching and learning Mathematics whereas communityand institutional secondary schools' students were found using more ICT tools than institutional school students so they have significance difference practices of ICT tools in learning Mathematics.

Keywords: ICT tools, mathematics class, teaching, learning, mathematical software

Background of the Study

ICT tools have clearly had an impact on education, including research, education, and learning. Numerous studies have shown how improving the quality of mathematics instruction may be beneficial. ICTs have the potential to boost mathematics teaching and learning, innovate, accelerate, enrich, and deepen skills, excite and engage students, assist connect school experience to work practices, and build economic viability for tomorrow's workers.

According to Jhurreev (2005), computers and applications of technology has become more pervasive in Mathematics education concerning about the need for computing skills in everyday life.

Using ICT technologies in mathematics education can improve meaningful learning more than traditional classroom instruction. According to Ashburn and Flodden (2006), a wider range of intelligence, connecting school with world, supporting integration, offering dynamic displays, multiple and linked representations, interactive models and simulation and the storage and retrieval of multiply categorized information. In the condition that the students of community schools practice ICT less in their Mathematics classroom, this article, therefore explores to identify community and institutional schools Mathematics teachers and students' practices of ICT tools in teaching and learning Mathematics.

Review of Previous Studies

Regarding the research topic "practices of ICT in teaching and learning mathematics, I studied the existing literature. In order to examine the use of ICT in mathematics instruction and learning at Heartland Children's Academy, Shrestha (2015) conducted a study named "Status of ICT use in teaching/learning Mathematics." Similarly, Shah (2017) studied "Teacher attitude towards media in teaching mathematics" to compare and determine how community school and institutional math teachers felt about using media in the classroom. In addition, Timilsena (2017) investigated the attitude of teachers toward ICT in mathematics instruction in order to investigate how they adapt Vygotsky's constructivist theory of learning, which is dependent on previous knowledge connection with ZPG.

Similarly, Danai (2017) conducted a study titled "Effectiveness of Information Communication and Technology (ICT) in Teaching Geometry" to determine how well ICT works for teaching geometry at the secondary level and to compare the academic performance of students who were taught using ICT tools versus those who were not. Similarly, Saud (2018) investigated "Attitude of Students and Teachers of Using Audio-video Aids in Learning on Secondary Level at Surkhet District" in order to investigate how students and teachers feel about using audio-visual aids for teaching and learning mathematics and the difficulties that come with it. Likewise, the dissertation "The Use of

ICT in Teaching Mathematics - A Comparative Analysis of the Success of Seventh Grade Primary School Students" was presented by Tomjanovich and Zuko (2016).

Additionally, Ibrahim (2016) studied the "ICT tools' influence on teaching and learning activities." According to the overview above, there have been a lot of studies on ICT technologies and their benefits for math instruction. Therefore, the purpose of this study is to determine how ICT tools are used by Mathematics teachers and students in both community and institutional schools.

Methodology

To explore the uses of ICT tools in community and institutional schools' Mathematics classrooms, I modified the survey research design in this quantitative method research study context as flexible research too, but all of them are defined by the use of standard questionnaire forms that are administered over the phone or in person, via postal pencil-and-paper questionnaires, or increasingly via web-based and email forms (Muijs, 2004). My whole research procedure was driven by this study strategy, which involved gathering data in-person via a questionnaire from 40 institutional and 73 community schools (Education Development and Coordination Unit, 2076), By splitting the total number of schools in the Okhaldhunga district into two strata community and institutional schools, I used stratified random method to select 15 community and 8 institutional secondary schools, 30 Math teachers from community schools and 16 from institutions were chosen as the sample population, and 90 students from community schools and 56 students from institutions were given tests covering four dimensions: social media (You Tube, Facebook Messenger), online resources (Gmail, Google), mobile applications (Microsoft Mathematics, malMath, math solver, High school math All Math formula, etc.), and mathematical software (GeoGebra, Midas Class). The tests were given on a 5-point rating scale across 41 distinct statements.

By administering a pilot study exam to five community and five institutional math instructors in the Okhaldhunga region, the instruments' reliability was confirmed. Version 21.0 of the Statistical Package for Social Sciences (SPSS) software was used to compute the collected data, with a significance level of 0.05. In order to determine how teachers and students use ICT tools for teaching and learning mathematics, percentages and chi-square values were calculated for each statement at the 0.05 level of significance. For the second objective, which was to compare the use of ICT tools by mathematics teachers and students in community and institutional secondary schools, mean and standard deviation were computed using a t-test at the 0.05 level of significance.

Discussions and Findings

After dealing about statistical analysis and interpretation of collected data about practices of ICT tools in teaching and learning Mathematics, following findings were found:

Teachers Practices of ICT Tools in Teaching and Learning Mathematics

Social media, online resources, mobile applications, and mathematical software were the most often utilized ICT tools among math instructors for both teaching and studying mathematics. These ICT resources were considered to be useful for improving the effectiveness of their lessons.

It was discovered that both instructors and students utilized social media ICT resources, such as YouTube, blogs, Facebook, and Messenger, in the teaching and learning of mathematics. According to claims 1–13, over 50% of math instructors said they always and regularly used Facebook and Messenger as ICT resources for teaching and studying math, 30% said they never used them, and only 20% said they occasionally used them. Similarly, just 10% of instructors were found not to use Gmail at all for data transfers, compared to 90% who were found to use it often. Among constructors who used Gmail to provide homework in mathematics, 76.9% reported never utilizing the service, while 23.1% reported using it consistently to deliver assignments to their pupils.

Regarding the use of multimedia projectors in mathematics classes, no teachers were seen doing so. In a similar vein, the $\chi 2$-value for utilizing Google in math classes was 48.56, which appears to be noteworthy. The statement "I use Google" was agreed with by 56.5% of instructors, whereas the smallest percentage of teachers "do not agree" with this statement, regardless of whether they utilize Google in their math classes. It was discovered that over 50% of students utilized Google in math classes, which appears to be rather good, and 21% of professors had confusion while utilizing Google to support their assignments.

At the same time, less than one-third of instructors were found sometimes using Google to look up mathematical problems and majority of instructors never used Google. With respect to their pupil's Google usage preferences, a $\chi 2$-value of 1.82 was discovered which appears to be less significant. Twenty three percent of teachers consistently advised their students to use Google for reference, whereas the remaining teachers did not advise their pupils to use Google to look for answers to mathematical problems.

According to survey questionnaires given to math teachers about how frequently they use mobile applications when teaching math in the classroom, 39.1% of teachers said they always use them, while one-third said they never do. A $\chi 2$-value of 9 was discovered, which is in the crucial area. About one-third of instructors said "always and frequently," followed by "sometimes" (28.3%), and "never practice" (more than one-third). This finding shows that more than one-third of educators always utilized mobile apps for

teaching mathematics and two-third of educators never utilized it to prepare self for teaching mathematics. This shows that most of the teachers were not found using mobile apps for teaching mathematics. Furthermore, almost one-third of educators consistently recommended that students utilize mobile applications to solve mathematical problems, while 39.1% of educators were never advised to do so. Because of this, I discovered that around one-third of secondary school math instructors regularly utilized mobile applications to teach and learn the subject, whereas the majority of teachers never used them. It has been shown that math teachers in secondary schools have little experience using mobile applications.

A significant $\chi 2$-value of 87.79 was discovered when the issue of whether or not instructors utilize mathematical software when teaching mathematics in the classroom was asked. The chi square value is therefore greater than the crucial threshold. In all, 73.9% of instructors were found to have never used GeoGebra, and 26.1%, or the fewest number of teachers, occasionally used GeoGebra but never. This suggests that the majority of educators have never visualized geometrical theorems using GeoGebra. 78.3% of instructors have never used GeoGebra for self-preparation or projector-based math demonstrations in the classroom.

Similarly, statement 35's results indicate that 82.6% of teachers never used GeoGebra, and none of them ever used it to assign homework. When asked if they ever used Midas class to practice mathematics, 60.9% of instructors said they never did, while 39.1% said they did it frequently. The crucial value contained the chi square value. A total of 58.75% of instructors were found to have never utilized Midas class, while the smallest percentage of teachers consistently used Midas class to study new material and prepare themselves for teaching and learning mathematics. Furthermore, 41.3% of instructors were found to recommend Midas classes to make mathematics classrooms more effective, while 58.7% of teachers never suggested that their students join Midas classes to foster their mathematical knowledge and creativity.

The Cronbach's α was found to be 0.79(>0.60) which seems to be highly reliable result. Therefore, 70% of the secondary school's With a Cronbach's α of 0.79 (>0.60), the finding appears to be quite trustworthy. Consequently, it was discovered that 30% of secondary school math instructors utilized software to support math instruction, whereas 70% had never done so. However, no teacher ever taught and learned mathematics using GeoGebra. It has been determined that math teachers in secondary schools use mathematical software for teaching and studying mathematics at a minimum.

It was discovered that thirty percent of math teachers never utilized software to support math instruction. However, no teacher ever taught and learned mathematics using GeoGebra. It has been determined that math teachers in secondary schools use mathematical software for teaching and studying mathematics at a minimum.

Students' Practices of ICT Tools in Learning Mathematics

Only 28.9% of students were found to use Facebook, Messenger, and other websites seldom, while 71.1% of students did not use any social media sites to practice mathematics. These findings relate to the usage of ICT resources for mathematics instruction. The chi square value is more than the critical threshold, as indicated by the statement's $\chi 2$-value of 34.06, which appears to be significant. At the same time, it was discovered that the pupils hardly ever used Google and YouTube to practice math. It was astounding that just 1.4% of students utilized YouTube and Google sites consistently, 44.5% occasionally, and fewer than one-third never used YouTube to learn mathematics.

They did not self-prepare for studying mathematics by using such media websites. Almost one-third of the pupils never did comprehend mathematical ideas, 2.7% stated they understood, and the remaining children only occasionally understood. When asked whether they had ever downloaded mathematical problems from YouTube, more than half of the students reported that they had never done so, while less than half said they had done so occasionally. According to this data, the majority of their teachers never used YouTube videos in the classroom.

A third of all students have never used YouTube to get ready for an assignment. 29 students utilized YouTube to provide new ideas for learning mathematics, whereas 71% of students never used it. There was a non-significant $\chi 2$ value of 7.63. This indicates that the chi-square value falls within the critical range. Ninety-one percent of students stated that they never used Facebook or Messenger for math exercises, while 9% indicated that they used it infrequently. Thus, the findings indicate that only a small percentage of secondary school students used YouTube, Google, Facebook, and Messenger to practice mathematics; the remaining students did not utilize these platforms.

The significant $\chi 2$-value of 78.93 was reported for online resources utilized for practice in math classes. The chi-square value is, therefore, greater than the crucial threshold. Although 40% of students said they hardly ever used Gmail to learn mathematics and solve problems to illustrate mathematical answers in class, 60% of students said they never used it to turn in assignments. Just 9% of respondents said that their instructors had recommended Gmail for downloading mathematical problems, while 91% of respondents even stated that their teachers had not advised their pupils to exchange mathematical documents and turn in assignments on the platform.

A total of 12.3% of students reported using Google constantly to learn mathematics, while 87.7% said they only sometimes used it. Of all respondents, 34.4% occasionally utilized Google to look up mathematical problems, but less than one-third constantly and regularly did so. Based on these results, it was discovered that nearly all secondary school

pupils never utilized Gmail to study mathematics. However, the majority of pupils occasionally utilized Google to learn math.

The study showed that secondary school students' use of mobile applications to teach and learn mathematics had a significant $\chi 2$ value of 38.04, which was higher than the critical value. Just 10% of students reported never using a mobile application, compared to 39% who reported always using one. Furthermore, it was revealed that only few students always utilized mobile application for studying Mathematics and most of students never used any mobile application for learning Mathematics to self-preparation for Mathematics learning. Similarly, 39.7% of students said they never used a mobile application to practice mathematics, 19.2% said they did so occasionally or never, and 6.8% said they did so constantly.

This indicates that mobile applications have not been used in math classes in secondary schools. Only a small percentage of teachers recommended that their students use mobile applications to learn mathematics, while the majority did not encourage pupils to use them. The majority of secondary school students have never used a mobile application to learn mathematics, according the findings of the aforementioned study. Because of this, students in secondary school have little experience using mobile applications in math classes.

In terms of pupils using mathematical software in the classroom, very few were observed using programs like as GeoGebra and Midas class while studying mathematics. The $\chi 2$ value, which was discovered to be 470.50, is quite important. The chi square value is therefore greater than the crucial threshold. 8.2% of students said they occasionally used GeoGebra to examine visual representations of geometrical theorems and to prepare themselves for learning mathematical theorems, whereas 91.8% of students reported never used it in a classroom context. Similarly, 95.2% of students said they had never used Geozebra with their peers.

Just 10% of the sample population said that their teachers recommended using GeoGebra for mathematical exercise, while 90% of students said that their teachers did not recommend using it to foster mathematical understanding and creativity. Similarly, 95.2% of students said they had never turned in an assignment using GeoGebra. The $\chi 2$-value of 262.97 indicates that the chi square value is not inside the crucial zone. In terms of Midas class, 73.4% of students never used it to study mathematics, 1.4% always used it, and the other pupils did not utilize it at all. This demonstrates that the majority of educators have never implemented Midas' class to improve instruction and learning.

Most of the teachers never referred their students to use Midas class for learning Mathematics. Additionally, 65.8% of pupils said "never practices," less than one-third answered "sometimes practices," and only 0.7% answered "always practices." This

demonstrates that the majority of educators did not recommend that their pupils attend Midas' class in order to foster their creativity and learn mathematics. According to this research, 90% of secondary school students have never used GeoGebra to learn mathematics, 60% have never used Midas class to learn mathematics, and students have little experience with mathematical software.

Comparison of Community and Institutional School's Teachers Practices of ICT Tools

Based on data collected from secondary school math teachers and students in both community and institutional schools, I discovered useful ICT tool usage methods in math instruction. The mean score for community instructors is 2.53, but the mean score for institutional teachers is 2.82 when comparing these two schools. With a degree of freedom of 44, the SD for teachers in community and institutional schools was 0.77 and 0.59, respectively. The calculated t-value for the mean score difference at the 0.05 level of significance is -1.45, falling between the tabular value (±1.96).

Therefore, there is no discernible difference in how math teachers in community and institutional schools use ICT resources. The usage of ICT tools by math teachers in both community and institutional schools is found to be similar.

Comparison of Community and Institutional School's Students Practices of ICT Tools

While comparing students' practices of ICT tools in between community and institutional schools in practising mathematics, Mean and SD were computed, tabulated, and examined in Table 1.

Table 4.10

Students in community and institutional schools by mean, standard deviation, and t-value

Comparison	N	Mean	SD	Calculated Value	t-value	Decision
Community students	90	2.16	0.50	2.01	1.96	Significant
Institution students	56	1.99	0.41			

N=sample size=146

d. f.=degree of freedom ($N_1 + N_2 - 2$) = 90 + 56 -2 = 144

Ninety students attended community secondary schools, whereas fifty-six attended institutional secondary schools, according to the chart. With SDs of 0.50 and 0.41, respectively, and degrees of freedom of 144, the mean score for children attending community schools is 2.16, while the mean score for pupils attending institutional schools is 1.99. At the 0.05 level of significance, the reported result of ±1.96 did not match the

calculated t-value of 2.01 for the mean score difference. Children in community and institutional schools thus utilize ICT resources to study mathematics in very different ways. Researchers found that children in community schools are more successful than those in institutional schools in learning mathematics with the use of ICT resources.

Findings

Based on the conversation, it was determined that neither secondary school math teachers nor students were using ICT tools and technology more effectively. Based on the study, the following conclusions were drawn:

- More than half of secondary school math teachers were found to constantly use YouTube, and almost one-third of them occasionally used Facebook Messenger or Facebook to teach and learn math.
- While the majority of math teachers in secondary schools never used Gmail, a small percentage occasionally used so in order to teach and learn the subject. However, the majority of secondary school math teachers had little experience using mobile applications, and the majority of teachers regularly utilized Google to teach and learn mathematics.
- More than 70% of math teachers in secondary schools have never utilized GeoGebra or Midas classes to teach and study math. It has been determined that math teachers in secondary schools use mathematical software for teaching and learning mathematics at a minimum.
- More than one-third of secondary school pupils occasionally use YouTube, and the majority of them have never used Facebook or Messenger to study math.
- The majority of pupils in secondary schools occasionally use Google to learn mathematics, and nearly none of them ever use Gmail.
- Students in secondary school had little experience using mobile applications. Furthermore, more than 90% of secondary school pupils never used GeoGebra, and 60% of students never utilized Midas class to study arithmetic.
- It was discovered that secondary school pupils used mathematical software for learning mathematics in the bare minimum.
- The computed t-value for the mean score difference is -1.45, falling between the tabulated value of ±1.96. As a result, there was no difference in the use of ICT tools in mathematics instruction between math teachers in community and institutional schools.
- The computed t-value for the mean score difference of 2.01 that did not fall within

the range of the tabular value (±1.96). Students' use of ICT tools in community and institutional schools differs significantly as a result. As a result, pupils in community schools use ICT resources more effectively than those at institutional schools when learning mathematics.

Conclusion

Majority of the students and teachers were found not using Google, mobile apps, internet and ICT tools for solving Mathematical problems. The students and teachers who are using ICT tools in Mathematics class fond helpful and supportive in teaching and learning. In this situation, the development of ICT tools and technology highly influencing people and education system. The use of ICT tools in Mathematics education was found meaningful than traditional instructions. Therefore, to encounter negative impression towards Mathematics and for effective Mathematics learning, Tribhuvan university designed and implementing ICT course in Mathematics education since 2070. It was found that almost secondary schools Mathematics teachers never used Gmail, Google, Mobile apps, Zeo zebra and other ICT tools but least number of teachers sometimes used them in their teaching and learning Mathematics.

On the other hand, most of the teachers frequently used Google but least number of teachers never used Google in their teaching and learning Mathematics. On the other hand, most of the teachers were found frequently using Google but only few percentages of people were found rarely using Google and mobile apps. There were no appreciable differences between the use of ICT tools in Mathematics instruction and learning between Maths teacher in community and institutional schools. Majority of the teachers seemed to be using ICT tools for teaching and learning Mathematics. It was found that there were no discernible differences between Math instructors in community and institutional secondary schools in terms of how they used ICT resources to teach and study mathematics. Moreover, it was found that there were notable differences in a way that the students in community and institutional secondary schools used ICT resources to study mathematics. The pupils in community schools were found using ICT tools more effectively than those in institutional schools while learning mathematics.

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