

Teachers' Perceptions and Use of ICT Facilities in Teaching Mathematics: A Case of Selected Secondary Schools in Gasabo District, Rwanda

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Abstract: This study investigated the perspectives of mathematics teachers on the integration of ICT facilities in teaching within four public secondary schools in the Gasabo District. Employing a mixed-methods approach with 23 participants selected through simple random sampling, the study utilized a questionnaire, structured interview and classroom observation checklists for data collection. Results indicated a generally positive perception among mathematics teachers towards the incorporation of ICT in their teaching practices and their perceptions towards ICT in education support its integration into mathematics teaching practices. Notably, teachers actively utilized smartphones and computers for tasks such as writing lesson plans, creating teaching materials, grading and collaborating with peers. The study suggests ongoing encouragement for the use of technology in classrooms to further enhance ICT integration in secondary education.

Keywords: ICT facilities; ICT utilization; secondary schools; teachers' perceptions; teaching and learning; mathematics.

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Introduction

In the rapidly evolving landscape of education, the integration of Information and Communication Technology (ICT) has become pivotal. This study delves into the realm of teachers' perceptions and utilization of ICT facilities in the teaching of mathematics within selected secondary schools in Gasabo District, Rwanda. As digital tools become increasingly available, understanding how educators engage with these resources is crucial for enhancing the quality of mathematical education. As the educational landscape continues to evolve, understanding how teachers perceive and incorporate ICT tools into their mathematics

instruction becomes crucial for designing effective pedagogical strategies.

Gasabo District, situated in Rwanda, serves as a unique backdrop for this investigation, offering insights into the challenges and opportunities faced by educators in a specific cultural and regional context. This study sought to unravel the complexities surrounding the adoption of ICT in mathematics education. By examining the experiences of educators in Gasabo District, this study sought to contribute valuable knowledge to the broader discourse on the role of ICT in shaping the future of mathematics education in Rwanda and

beyond. The findings may inform educational policies, teacher training programs and curriculum development initiatives aimed at fostering a more technologically enriched and effective learning environment in secondary schools.

In recent years, there has been a global push to integrate Information and Communication Technology (ICT) into education as a means to enhance the teaching and learning process (Niyibizi et al., 2023). This trend is particularly evident in developing countries like Rwanda, where efforts are being made to leverage ICT tools in secondary education. Gasabo District, situated in Rwanda, is no exception to this transformative wave in education. In this context, the study focused on understanding the perceptions and utilization of ICT facilities by teachers, specifically in the teaching of mathematics at selected secondary schools in Gasabo District.

While there is a growing emphasis on incorporating ICT tools in education, it is crucial to examine how effectively these technologies are being embraced and utilized by teachers, especially in the specific domain of mathematics instruction. The problem at hand revolves around the need to assess the teachers' perceptions of ICT facilities and understand the extent to which these tools are integrated into their teaching practices. Additionally, identifying any challenges or barriers faced by educators in Gasabo District regarding the adoption of ICT in mathematics instruction is essential.

Related Literature

It has generally been believed that teaching, learning and training are the answers to all of society's problems. Nations necessitate that students learn mathematics because it is a scientific domain. It is beneficial to every individual and any nation's economic development. Hence, this subject is, more crucial to our everyday activities. Mathematics is supported by ICT for analyzing, connecting ideas, presenting and problem-solving. Mathematical formulae are readily accessible and very challenging to present on a blackboard. As a result, teachers and learners use ICT to enhance their teaching and learning. ICT has grown into a valuable instrument that has shifted perceptions of people in the world. Today, it is difficult to overlook the significance of information and communication technologies (ICT) in both teaching and learning as a whole (Nzayisenga et al., 2023).

ICT is becoming increasingly important in organizations and society's ability to create, access, adopt and apply information (Aribasala, 2006) the availability and accessibility of ICT facilities are also critical to effectively introducing technology into the school. Technology is essential in mathematics teaching and learning because it influences the mathematics taught and improves students' learning. Using technology to improve the teaching and learning is not a new challenge for academic institutions (Nzayisenga, et al., 2023). While Kaware and Sain (2015) demonstrated how difficult it has been for educators to use innovative technologies like email, audio and visual representations to enhance traditional teaching methods, Rwanda has made a progress toward the use of Information and Communication Technology (ICT) in the teaching and learning processes (Munyengabe et al., 2017; Nzayisenga et al., 2023) in public schools. Some primary and secondary school teachers were given computers in the program one Laptop per teacher and one Laptop per child. Nevertheless, there are significant obstacles to incorporating technology resources into mathematics instruction in secondary schools, such as inadequate training, lack of suitable tools and shortage of repair tools (Niyibizi et al., 2023).

ICT facilities used in the teaching and learning process include calculators, smartphones, computers, the internet, electronic notice boards, digital multimedia, overhead projectors, fax machines and so on (Babajide & Bolaji, 2003). ICT offers a variety of opportunities for mathematics teaching and learning at all levels of education (Munyengabe et al., 2017). In India, there was a critical need to use ICT to improve students' capacity for learning (Rani & Anisha, 2017). It is necessary to support the traditional teaching-learning approaches to enable students to be lifelong learners and successful contributors to their communities (Munyengabe et al., 2018).

Methodology

Research Design

This study used a convergent parallel approach. The study's convergent parallel design findings were documented in both quantitative and qualitative forms. In order to respond to the research problem, the design entailed collecting both quantitative and qualitative data at the same time, merging the data, to come up with findings.

Population and Sampling

Gasabo District in Rwanda was an ideal setting for a case study on teachers' perceptions and use of ICT facilities in teaching mathematics due to its dynamic educational landscape and commitment to technological integration. As one of the most populous and rapidly developing districts in the country, Gasabo made substantial investments in education, particularly in the deployment of ICT resources in schools. The district's proactive approach towards incorporating technology in education provides a rich context for examining how teachers navigate and harness ICT tools, specifically in the realm of mathematics instruction. To comprehensively understand the nuances of this integration, four public schools within the Gasabo District were selected as case study sites. These schools reflect the diversity of the district in terms of student demographics, infrastructure and resources. In this study, the target population comprised the 25 Deputies of Studies, 27 ICT teachers, 46 Mathematics Teachers in public secondary schools of the Gasabo District, making the total of 98 individuals. The accessible population, consisting of 4 Deputies of Studies, 4 ICT teachers and 15 Mathematics Teachers from four selected secondary schools was identified. Slovin's formula (1967) was employed to determine the sample size.

Instruments

The study used a questionnaire, an interview schedule and a checklist for classroom observation for data collection.

Validity and Reliability

To ensure the validity, the instruments were reviewed by a research expert to ensure that there

were no ambiguous statements. The comments were used to improve the statement's clarity and to correct grammatical and typographical errors. The reliability of the questionnaire was measured through the SPSS which yielded the Cronbach's Alpha of 0.877. Therefore, the questionnaire was reliable for data collection. The reliability was further improved through data triangulation, which is the use of more than one instrument for data collection.

Statistical Treatment of Data

Data was analyzed using the descriptive statistics and the thematic approach.

Ethical Considerations

The researcher sought an appropriate arrangement with the University of Rwanda-College of Education, Director of Research and Innovation through the African Centre of Excellence for Innovative Teaching and Learning Mathematics and Science (ACEITLMS) Directorate to be granted a letter allowing to carry out the study. The researchers sought consent from respondents before working with them. All the data was kept confidential. The researchers followed the ethical guidelines that govern and direct academic research to the best of his ability. In addition, the researchers made sure that every idea from another work was properly referenced, cited and given due credit.

Findings and Discussion

Demographic Information of Respondents

It was essential to identify the demographic characteristics of the respondents. These included gender, academic qualification and teaching experience.

Table 1: Respondents Information

Demographic information		Percentage
Gender	Male	59.09%
	Female	40.91%
Academic qualification	Advanced Diploma (A1)	13.64%
	Bachelor's degree (A0)	86.36%
Teaching experiences	Less than three years	27.27%
	Greater than or equal to three years	72.73%

Table 1 shows that male respondents constituted 59.09% while female respondents constituted 40.91%. Therefore, the majority of respondents were males compared to the female counterparts. Regarding academic qualifications, those with advanced diploma constituted 13.64% while those with bachelor's degree constituted 86.36%.

Therefore, the majority of respondents occupied bachelor's degrees. As far as teaching experience is concerned, 27.27% of respondents had lesser than three years of experience while 72.73% had the experience of greater than or equal to three years. Therefore, the majority of respondents had the experience of three years and above.

Research Question 1: What are teachers' perceptions of the use of ICT facilities in teaching mathematics in selected secondary schools in Gasabo District?

This research question called for teachers to indicate their perceptions on the use of ICT facilities

in teaching mathematics using the five point scale whereby 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. The mean scores were interpreted as follows: 1.00-2.49 = disagree (negative), 2.50-3.49 = neutral, 3.50-5.00 = agree (positive).

Table 2: Perception of Teachers Regarding the Use of ICT Facilities in Teaching Mathematics

SN	Teachers' Views on the Use of ICT Facilities	Mean	Interpretation
1	ICT facilities encourage students to learn mathematics.	4.64	Positive
2	ICT facilities increase students' attention in mathematics learning	4.57	Positive
3	I have skills to use ICT-based instructional-learning activities	4.43	Positive
4	The use of ICT improves efficiency of constantly updating daily lessons	4.14	Positive
5	ICT facilities make mathematics lessons interactive.	3.29	Neutral
6	ICT facilities enhance how mathematics lessons are taught	3.00	Neutral
7	ICT is enjoyable as it inspires and makes mathematical ideas very clear	3.00	Neutral
8	I incorporate ICT facilities in mathematics teaching	2.71	Neutral
9	I am comfortable using ICT facilities in teaching mathematics	2.36	Negative
Overall mean		3.57	Positive

In table 2, the overall mean score for teachers' attitude was between 3.50 and 5.00, suggesting agreement with the statements in the questionnaire and therefore having a positive attitude toward the use of ICT in teaching and learning of mathematics. While some few items scored neutrality and one item was negatively perceived, the overall mean still suggests the generally positive perception toward the use of mathematics in teaching and learning mathematics. The recent results align with Nzayisenga et al. (2023) who revealed positive perceptions among teachers towards integrating technology into their teaching of mathematics. Furthermore, the study considered Information and Communication Technology (ICT) as important in facilitating the teaching and learning process. Therefore, the findings in the present study are worthy recognition.

Research Question 2: Does the perception toward the use of ICT support or hinder the use of ICT in mathematics teaching?

Having explored the positive perception toward the use of ICT in teaching mathematics, this research question sought to establish whether the perception toward the use of ICT support or hinder the use of ICT in mathematics teaching.

The study revealed that the overall positive perception toward the use of ICT in teaching mathematics was accompanied by the actual use of the same in the teaching and learning process. This was indicated by the information from the observation schedule where it was uncovered that

writing lesson plans, creating teaching materials, tracking and computing student grades and corresponding with other teachers were done using smartphones or computers (Summary of observations of a recent study).

The teachers' use of ICT in teaching mathematics was further supported by the interview schedule report where one of the respondents had this to say:

All teachers use the Comprehensive Assessment Management Information System (CA-MIS) to record all ending unit assessments given to students at schools; mathematics teachers are among those teachers, which means that the mathematics teachers are familiar with and actually use ICT facilities in facilitating the learning of mathematics.

The current results are in line with the findings of Munyengabe et al. (2017) which highlighted that the integration of information and communication technology (ICT) in the teaching and learning process provided various opportunities for enhancing subject understanding across all education levels. This underlines the potential of ICT to positively influence education by adopting a more comprehensive understanding of subjects at various educational stages.

Conclusions and Recommendations

The study affirms positive alignment with Information Communication and Technology integration in mathematics education as evidenced by participants' favorable attitudes towards the use of ICT in teaching and learning. Their positive perception toward the use of ICT support the integration of ICT into mathematics teaching practices. Therefore, teachers are encouraged to leverage digital tools for enhanced teaching experiences; they should actively incorporate technology into teaching tasks, raising an environment where technology is integrated for improved learning outcomes.

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