The Relationship Between ICT Use and Teaching of Mathematics in Secondary Schools of Kalungu District, Central Uganda

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Abstract

Teaching of mathematics in schools is very important and results into improved academic performance and increased involvement of learners in lessons. The educational sector in Uganda has made series of changes and reforms to improve teaching of Mathematics. This study explored the influence of Information Communication Technology (ICT) in the teaching of mathematics in Secondary Schools of Kalungu District. The study objectives were to; (i) examine the extent to which ICT is used by teachers of Mathematics, (ii) establish the effectiveness of teaching Mathematics, and (iii) examine the relationship between ICT use and the effectiveness of teaching of Mathematics in Secondary Schools of Kalungu District. Correlational type of design was used for the study whereby questionnaires from mathematics teachers and interview guide head. A sample size of 132 respondents participated in the study. Quantitative data was analysed using the SPSS version 20 where both univariate (frequencies, percentages and mean scores) and bivariate level (Pearson coefficient correlation) were used while qualitative data was analysed by quoting subthemes. The study discovered that the level of ICT use among teachers of mathematics in Kalungu District has an overall mean of 2.25 (on a scale of 1-5 point Likert scale) implying a moderate usage of information communication technology; the effectiveness of teaching mathematics in secondary school in Kalungu District was high with an overall mean of 4.05 (on a scale of 1-5 point Likert scale). Pearson correlation coefficient $r = 0.086$ showed that there was a weak positive correlation between ICT use and the effectiveness of teaching of Mathematics. The p-value of 0.373 which is above the threshold value of 0.05 shows that there is no statistically significant relationship between ICT use and the effectiveness of teaching of Mathematics. In conclusion, the findings suggest that the use of Information Communication Technology (ICT) in Mathematics teaching within Kalungu District's Secondary Schools remains limited, with few educators embracing these tools. However, there is a prevalent perception of effectiveness in Mathematics instruction, as evidenced by relatively higher mean scores and frequencies, indicating a positive consensus among educators regarding their teaching practices. It was recommended that schools and educational institutions should explore strategies to bridge the gap between ICT

integration and teaching effectiveness by providing ongoing professional development opportunities that focus on effective integration techniques. Formal policy guidelines for ICT use should be put in place, so that all teachers can attend in-service training programmes, at least once every academic year, to update themselves with relevant skills for ICT use in teaching mathematics.

Key Words:Relationship, ICT use, Teaching of Mathematics, Secondary Schools

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Introduction

Globally, the ICT use in mathematics teaching has demystified the notion that Mathematics is a very hard subject, and it has led to better performance by students in the subject (Lockard & Abrams, 2017). There is growing awareness of ICT use because it is strongly inclined by the setting and conditions under Mathematics teaching (Mbwesa, 2018). In Africa, ICT use is one of the key propellers for school improvement in performance of Mathematics in most secondary schools (Hargittai, 2019). In the post-colonial period (1960-1980s), there was a reform of mathematics teaching in African states which was afflicted by international cooperation (Furinghetti, 2014). The reform drew out implications for policy makers in education and for improving classroom practice (Allessi& Trollip, 2017). In East Africa, ICT use in the teaching of Mathematics supports the development of 21st century skills that include; collaboration, problem-solving, decision-making, critical thinking, creativity and innovation (Amuko, Miheso&Ndeuthi, 2015).

In Central Uganda, ICT use can improve quality of teaching Mathematics in secondary schools (Busulwa&Bbuye, 2018). Kule (2021) found out that ICT use in teaching is efficient in improving the logical and arithmetical skills in Mathematics. Teaching of mathematics in schools is very important and results into improved academic performance and increased involvement of learners in lessons (Clark, 2015). The educational sector in Uganda has made series of changes and reforms to improve teaching of Mathematics. One of such strategies involves ICT use. ICT use in teaching is a relevant and functional way of offering education to learners that will help them to imbibe the necessary level for the world of work. The government of Uganda as articulated in the NDP III, Uganda vision 2040 and the NRM manifesto (2021-2026) has adopted ICT as a key enabler of socio-economic transformation. ICT can make education more accessible and affordable (Daily Monitor 23rd September, 2021). It also allows self-paced learning making the teaching and learning more productive and meaningful. Through the Ministry of Education and Sports, the government has put in efforts to improve ICT use and Mathematics teaching in secondary schools by supplying ICV equipments to secondary schools, to support the teaching of Mathematics, establishment of good teachers and salary increment to science teachers.

Despite the above efforts, Mathematics teaching remains wanting in Secondary Schools of Kalungu District (Kalungu District Education Officer Report, 2019). This is evidenced by the district education report (2020), which shows that only 15% of the schools in Bukulula sub-county have a well-stocked library with computers, out of 15% only 8% can afford to buy computers for online learning and teaching. The distant home learning which would support continued learning during covid-19 and post covid-19 pandemic was impossible among schools in the rural district in Kalungu (Kalungu District Education

Report, 2020). This makes use of ICT for Mathematics teaching difficult, and teachers continue to rely on traditional teaching methods to facilitate the teaching of Mathematics among these schools.

If this situation is not addressed, the students' zeal to offer Mathematics will continue to diminish, which will eventually lead to low numbers of students offering studies that involve Mathematics. The prospective generations will therefore end up with low innovativeness and lack of logical problem- solving skills. Different studies for instance Laurillard (2019); Kirkok&Karanja (2018) Deng et al. (2014); and Buabeng-Andoh (2012) have been done on ICT use in other fields leaving out the usage of ICT in Mathematics teaching in secondary schools of Kalungu. It was therefore this problem that this study was aimed at investigating the influence of ICT use on the teaching of Mathematics in Secondary Schools of Kalungu District.

Purpose of the Study

To examine the relationship between ICT use and teaching of Mathematics in Secondary Schools of Kalungu District.

Theoretical Review

This study employed constructivism theory developed by Lev Vygotsky (1978) as quoted by Fosnot (2013). Constructivism theory suggests that teachers can guide students to use technology to investigate mathematical concepts. The constructivism theory has it that teaching mathematics using ICT has significant positive effects since the students are active agents in the arrangement of acquiring knowledge. Fosnot (2013) supported many allegations of constructivist theory among instructional developers, considering that the learning results should be focused on the knowledge construction process and the learning goals determined from authentic tasks with specific objectives. The theory explains how teachers' and students' access to ICT increases student participatory learning activities which can increase their knowledge and understanding Mathematics problems. In support of the above, Dennick (2016) noted that constructivism is a method of teaching and learning based on the premise that learning is the result of "mental construction. The theory proposes that humans construct knowledge and meaning from their own experiences. Driscoll (2000) explains that constructivism theory matches with reality. Despite the fact that constructivism theory is applicable in this study, it has many limitations. Authors for example Laszcz (2021) criticized the theory because the trainings necessary for constructive teaching are costly and unreasonable for school budgets as well as disruptive to students' learning.

Methodology

Research Design

This study was guided by the correlational research design to examine the relationship between ICT use and teaching of mathematics which includes; preparation, presentation and assessment. Quantitative data was the basis for drawing statistical inferences by relating the independent and dependent variables. Qualitative data supplemented the quantitative data by providing detailed information in form of statements from interviews for in-depth analysis. The study targeted 22 head teachers and 110 teachers of Mathematics. Head teachers participated in the study because they are responsible for overseeing school Information Communication Technology use and the teaching of Mathematics, and so have relative information concerning teaching of Mathematics. Teachers of Mathematics participated in the study because they are the ones responsible for using ICT in teaching of Mathematics. The study employed different sampling techniques to select participants. Selection of Mathematics teachers was by simple random sampling. Selection of head teachers was by purposive sampling technique. The researcher used a sample size of 132 respondents that is; 22 head teachers and 110 Mathematics teachers. The study employed the questionnaires, interview guide and document checklist as tools of data collection. Qualitative data was analysed using thematic analysis and content analysis methods. While quantitative data was analyzed using statistical package for the social sciences to general frequencies, percentages, means scores, and correlations.

Results

Table 1: Mean ICT use by Teachers

Mean		Frequency (110)	Percent
Valid	1.6	2	1.8
	1.7	13	11.8
	1.8	1	.9
	1.9	14	12.7
	2.0	12	10.9
	2.1	4	3.6
	2.2	11	10.0
	2.3	18	16.4
	2.4	10	9.1
	2.5	9	8.2
	2.8	2	1.8
	2.9	2	1.8
	3.0	3	2.7
	3.1	5	4.5
	3.2	2	1.8
	3.3	2	1.8
Overall mean	2.25		

The findings in Table 1indicate that the highest and lowest means were 3.3 and 1.6 respectively. This implies that very few teachers of mathematics integrate ICT in their teaching and to confirm this, a histogram was generated.
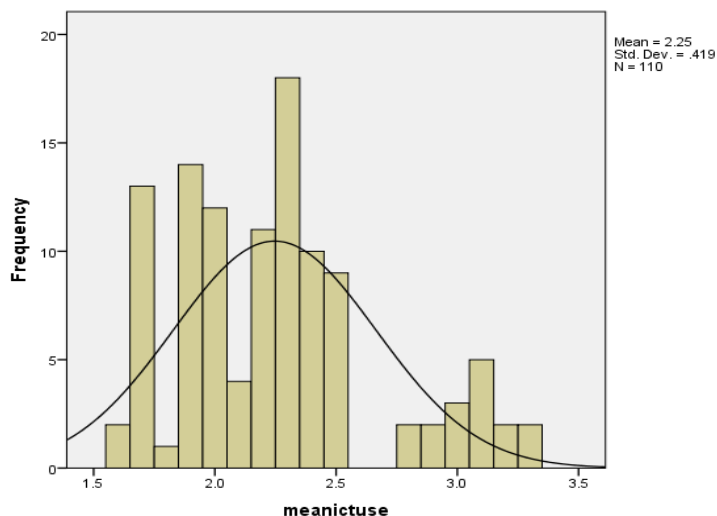
Figure 1: Histogram for mean ICT use by teachers.

The histogram curve shows a normal positive distribution.

In an interview conducted with a certain head teacher, it was revealed that;

"…the young teachers are more compliant to ICT use compared to the others who at times may lack the skills".

Table 2: The teaching of Mathematics in Secondary Schools of Kalungu District

Mean		Frequency (110)	Percent
Valid	3.1	2	1.8
	3.4	2	1.8
	3.5	6	5.5
	3.7	7	6.4
	3.8	11	10.0
	3.9	5	4.5
	4.0	17	15.5
	4.1	14	12.7
	4.2	17	15.5
	4.3	10	9.1
	4.4	14	12.7
	4.5	2	1.8
	4.6	3	2.7
Overall Mean	**4.05**		

The findings in Table 2: indicate that the highest mean of 4.6 has a frequency of 3 constituting a percentage of 2.7 while mean=4.0 and 4.2 have the highest frequency of 17 with a percentage of 15.5. This implies

that the teaching of mathematics in Secondary Schools is generally effective and to confirm this, a histogram was generated.
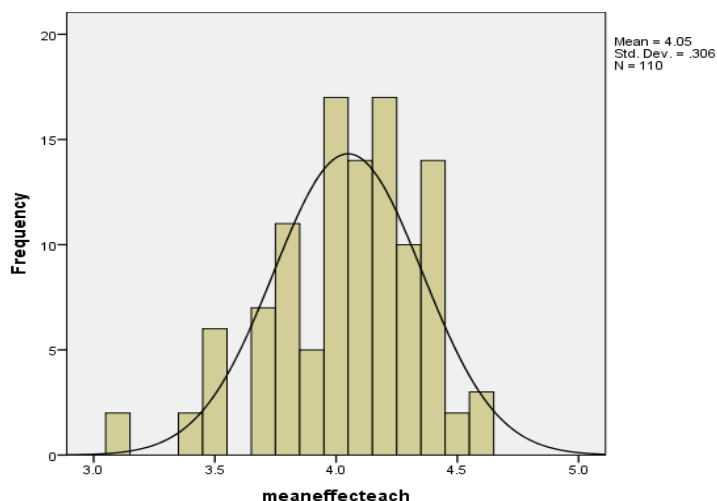
Figure 2: Histogram for mean teaching of mathematics

The histogram curve shows a normal positive distribution.

In an interview with certain head teachers, it was revealed that;

"*……one's age in the teaching process does not matter but what matters are the skills, mode of delivery and availability of the instructional materials.*" All other head teachers were also in agreement.

Table 3: Pearson's Correlation between ICT and teaching of Mathematics

		ICT use	Teaching of Mathematics
ICT use	Pearson Correlation	1	.086
	Sig. (2-tailed)		.373
	N	110	110
Teaching of Mathematics	Pearson Correlation	.086	1
	Sig. (2-tailed)	.373	
	N	110	110

This study was guided by a null hypothesis which stated that "There is no statistically significant relationship between ICT use and teaching of Mathematics in Secondary Schools of Kalungu District". A Pearson's product correlation was run to establish the relationship between ICT use and the teaching of Mathematics in Secondary Schools of Kalungu District. From the results above (*r = 0.086*, p =0.373, N= 110) show that there is weak positive correlation between ICT use and teaching of mathematics. The p-value of 0.373 which is above the threshold value of 0.05 shows that there is no statistically significant relationship between ICT use and teaching of Mathematics.

Discussion of the findings

The results show that there is a negligible positive correlation between ICT use and the teaching of Mathematics ($r = .086$, p = 0.373) which would mean that ICT use is not a predictor of mathematics teaching. The study further found out that there was no statistically significant relationship between ICT use and teaching of mathematics in Secondary Schools of Kalungu District. These findings concur with scholars like Buabeng-Andoh (2012) who carried out a study about factors influencing teachers' adoption and integration of Information Communication Technology into teaching in schools in Ghana. The resultssignified that seven barriers existed while integrating ICT into lessons. These hindrances were (i) lack of confidence among teachers during integration (21.2% responses), (ii) limited access to resources (20.8%), (iii) limited time for the integration (16.4%), (iv) lack of effective training (15.0%), (v) facing technical problems while the software is in use (13.3%), (vi) lack of personal access during lesson preparation (4.9%) and (vii) the age of the teachers (1.8%).Similarly, Dennen (2013) opines that use of ICV equipments like electronic mail (e-mail), short message service (SMS), video chat (For example, Skype), online social media among others provides a wide range of methodological benefits in various instructional settings such as provision of meaningful chances for sharing of resources, promotion of collaborative learning and an inclination towards greater learner autonomy. These findings therefore indicate that ICT complements teaching of mathematics but with a small significance. They also indicate that the usage of ICT in teaching of mathematics is affected by personal characteristics.

Conclusion

The study further found out that there was no statistically significant relationship between ICT use and the teaching of mathematics ($r = .086$, p = .373) in Secondary Schools of Kalungu District. This therefore implies that ICT use has a negligible effect on the teaching of Mathematics.

Recommendations

Formal policy guidelines for ICT use should be put in place, so that all teachers can attend in-service training programmes, at least once every academic year, to update themselves with relevant skills for ICT use in teaching mathematics.

Teachers should be encouraged to attend ICT use seminars and subject retooling workshops so as to meet the dictates of the ever-rapid technological changes in education.

Government through the ministry of education and sports should provide adequate funding to facilitate ICT use in all secondary schools to enhance the teaching of Mathematics.

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