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Information and Communication Technology Usage and Students' Academic Performance in Science Subjects in Rwanda: A case of Public Day Secondary Schools in Nyamasheke District

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Abstract

The purpose of this study was to investigate the information and communication technology usage on students' academic performance in science subjects in Rwanda using a case of public day secondary schools in Nyamasheke District. The specific objective was to identify the ICT Tools used in teaching and learning in public day secondary schools in Nyamasheke Disrrict,Rwanda, to To measure student's ICT skills in science subjects in public day secondary schools in Nyamasheke Disrrict, Rwanda, to determine the effect of ICT usage on students' academic performance in science subjects in public day secondary schools and analyse factors intervening in the use of ICT for improving students' academic performance in science subjects in public day secondary schools in Nyamasheke Disrrict, Rwanda. This study used a descriptive survey research design and working both quantitative and qualitative techniques.The targeted 225 respondents comprising 132 students, 6 secondary teachers, 6 directors of studies and 6 secondary school headteachers. Using Yamane's formula, the final sample size was 132 pupils. Census was applied to determine the 6 headteachers 6 directors of studies and 6 teachers.Questionnaire and interview guides were used to collect data. Using Statistical Product and Service Solutions version 21.0, variables were evaluated to produce measures of central tendency, dispersion, and frequencies. Content analysis was used to analyze interview results. Results indicated that teacher's skills on ICT usage in teaching sciences (Mean=3.49; SD=1.02>0.5). It was agreed with a mean of 3.03, standard deviation was 1.049 where respondents strongly agreed with the use of electronic textbooks. Results felt 49.4% a mean of 0.067 and 10.1 for sdv of 0.67. 47.2% strongly agreed that the management of students, Increased Students' interest in Sciences is effective on a mean of 1.32 and sdv of 0.43. Results evidenced that using ICT tools improved grades in sciences and increased students' interest. Results evidenced that the correlation between teacher's skills and ICT usage was 0.852**. The study recommends that public institutions should focus on improving electronic-libraries.School principals should organize in service training to enhance knowledge related to the use of ICT tools. Head Teachers should imovlve parents as well as the government on the role of increasing availability, accessibility and usability of suitable ICT tool usage. Teaching staff members should generate simple aids in order to see what they are discussing about in the lessons.

Keywords: ICT, Academic Performance, Science, Day schools

1.0 Introduction

In any discussion of academic accomplishment, the learning of the students remained fundamental (Lukindo, 2016). ICTs have given educational institutions, such as secondary schools, the possibility to employ technology to improve and assist teaching and learning. Usually, the goal remained to raise academic achievement. Rwanda's strategic aim is to increase the use of ICT to improve teaching and learning and support the growth of quality at all educational levels. ICT adoption in education is crucial to achieving this objective since it is the only way to make the kind of fast social and economic improvement envisioned in Vision 2050. The availability of devices lonely, however, falls short because ICT in learning envoronment merely serves as an instrument of enhancing teaching and learning. Therefore, current ESSP acknowledges necessity for ICT requirement for implementing among other including offering the continues proffessional trainings for utilising proper methodology to optimise the application of ICT to improve the quality of educational results through transforming teaching and learning. The growth of fundamental infrastructure and services is necessary for the rising use of ICT. Only 32% of elementary schools and 51% of secondary learning institutions are connected to the energy grid., while only 19% of secondary schools have Internet connections, according to 2016 EMIS data (MINEDUC, 2016). Concern was raised because, despite the fact that Rwanda's central region continues to dominate UCE scores (Ladu 2014), and Nyamasheke holds one of the lowest positions among the underperforming districts in the country (Nwigbo & Madhu, 2016). The research thus endeavored to investigate the impact of ICT on the academic achievements of students studying scientific subjects in secondary schools located in Nyamasheke district.The general objective of the study determines whether ICT usage in teaching and learning in classroom instruction has any influence on student's academic performance in science day secondary schools in Nyamasheke District.

i To identify the ICT Tools used in teaching and learning in public day secondary schools in Nyamasheke Disrrict,Rwanda

ii To measure student's ICT skills in science subjects in public day secondary schools in Nyamasheke Disrrict, Rwanda

iii To determine the effect of ICT usage on students' academic performance in science subjects in public day secondary schools.

iv To analyse factors intervening in the use of ICT for improving students' academic performance in science subjects in public day secondary schools in Nyamasheke Disrrict, Rwanda.

2.0. Review of Related Literature

2.1 Empirical Literature

In many developing countries, children who attend school especially in rural areas do so for only few years, often dropping out when they are in their early teenage years (Mlowosa, et al, 2014. Academic performance of students is not influenced by the above factors but also influenced by ICT usage in teaching and learning that far was discussed in the literature.

2.1.1 ICT Tools usage in Teaching and Learning

The process of integrating ICT technologies into teaching and learning is difficult and may encounter a number of challenges. The word challenges describes these issues, challenge is "any circumstance that makes it difficult to advance or to achieve an objective.The difficulty of always having access to computers was a complaint among teachers. According to Shamim and Raihan (2016), because computers had to be rented ahead of time, teachers who wanted to engage with students on different projects simultaneously were unable to schedule numerous reservations for computers. To put it another way, a teacher would not have access to most ICT tools since instructors shared them. According to the author, because computers had to be rented ahead of time, teachers who wanted to engage with students on different projects simultaneously were unable to schedule numerous reservations for computers. In other words, a teacher would not have access to them because the majority of ICT resources were shared among instructors. According to Steinberg and Garrett (2016), ICT resources are not always inaccessible because ICT materials are not readily available in the classroom. It might be caused by a variety of factors, such as a lack of personal access for instructors, poor resource management, deficient technology, inappropriate software, or faulty hardware.

2.1.2 Analysis of Academic Performance in Science Subjects

Science exam performance is typically poor at Rwanda's public day secondary schools. Students' interest in the subject, the abstract and difficult character of the concepts, and the predominance of teacher-centered methods are all contributing factors to students' poor performance. Thus, there is a need for a cutting-edge method that can increase students' interest and communicate science ideas more plainly (Thakral, 2015). Accoring to Dicksom (2015) the study that sought to advance technology in teaching sciences using IT concept at the secondary school level have improved the performance. The study recommended emphasis being encouraged for all students to perform better in sciences; that science subjects should mainly be provided separately when students join secondary schools. Additionally, one of the key prerequisites for students' admission to study science, engineering, agriculture, technology, and other relevant subjects in tertiary institutions must be taken into consideration is the pass rate of students at this level. That is the reason why the goverment of Rwanda through Rwanda Education High Council has decided that any student before being admitted in any university programm must have at least two principle passes (Tripathi & Jigeesh, 2015). Failure to have the principle pass, the candidate should spend at least five years in industry where he or she has got practical working expeence.

2.1.3 Effect of ICT usage in Science Subjects

According to research, ICT can significantly improve and expand practical work. While mobile computers, for instance, provide up new possibilities for data collecting and analysis in the field, digital video may be used to record processes that cannot be watched in real time (Alahakoon & Chiran, 2015). The most important use for assisting with actual work, though, is certainly data logging. These devices, which use electronic means to record and store measurements, collect data more quickly and accurately, improving the quality and quantity of the output. Data recording, which also offers flexibility and allows for the gathering of data outside of the lab or over extended periods of time. ICT motivates students. As students advance through school, they frequently lose interest in science, which is a major concern (Blaak, *et al*., 2013). According to research, ICT may assist address this by allowing students to have greater control over their education and study subjects that are pertinent to their own life. The greatest potential for motivation exists maybe when using the internet for project-based learning, even though data logging and modelling tools provide students more choice (Copriady, 2015). Students can access actual data on the internet, engage with classmates and scientists, and ultimately contribute to "real" research thanks to the internet. A larger variety of skills and learning preferences can be accommodated via project-based learning.

According to Ibieta, *et al*., 2017) one significant advantage of ICT is its capacity to shift the focus of practical labour from mechanical to analytical operations. The mechanical elements are lessened by data logging and graphing tools, but they are entirely eliminated by simulations. Simulations can enhance scientific comprehension by reducing inaccuracy in experimentation and increasing visual influence. However, in order for simulations to be as effective as possible, they must be interactive. Students' higher-order thinking and investigative abilities may be developed by giving them the opportunity to make predictions, test ideas, and receive quick feedback. Girls in particular likely to benefit from using them.Another way that ICT influences pedagogy is through the enormous pedagogical expectations that its effective application in science sets on teachers. Teachers need to be aware of the implications of a given application and comprehend how it will help students teach (Ladu, 2014), they should be aware that simulation-generated "sanitised" data may lead to incorrect assumptions. Similar to this, students require information literacy abilities so they can assess the data they discover online (Levstik & Barton, 2015). Giving students more responsibility for their work is the key, according to research, to using ICT effectively, educators should guide, supervising recherches and promoting dialogue. However, the science curriculum forces instructors to cover a lot of material; this is a barrier to creativity.

2.1.4 Factors intervening in the use of ICT.

The difficulty of always having access to computers was a complaint among teachers (Shamim & Raihan (2016). To put it another way, a teacher would not have access to most ICT tools since instructors shared them. According to the author, because computers had to be rented ahead of time, teachers who wanted to engage with students on different projects simultaneously were unable to schedule numerous reservations for computers. According to Steinberg and Garrett (2016), ICT resources are not always inaccessible because ICT materials are not readily available in the classroom. The study recommended emphasis being encouraged for all students to perform better in sciences; that science subjects should mainly be provided separately when students join secondary schools (Tripathi & Jigeesh, 2015). ICT can significantly improve and expand practical work. While mobile computers, for instance, provide up new possibilities for data collecting and analysis in the field, digital video may be used to record processes that cannot be watched in real time (Alahakoon & Chiran, 2015).The greatest potential for motivation exists maybe when using the internet for project-based learning, even though data logging and modelling tools provide students more choice (Copriady, 2015). According to Ibieta, *et al*., 2017) one significant advantage of ICT is its capacity to shift the focus of practical labour from mechanical to analytical operations. Giving students more responsibility for their work is the key, according to research, to using ICT effectively, educators should guide, supervising recherches and promoting dialogue. However, the science curriculum forces instructors to cover a lot of material; this is a barrier to creativity.

2.2 Theoretical Framework

2.2.1 Theory of Educational Productivity

A theoretically grounded theory of educational productivity was put out by Lukindo (2016) To improve student attainment of cognitive and affective outcomes, Walberg's approach calls for the optimization of nine elements. These nine constructive factors include: Developing abilities, age, motivation, self-concept, teaching quality, experience with instruction quality, and age, the environment at home, the environment in the school, the environment among peers and the media. Three main categories were used to organise these factors. In 2012, Wilkins et al. identified three types of environmental factors: (1) personal factors such as past accomplishment, age, motivation, or self-concept; (2) instructional factors such as instructional quantity or quality; and (3) environmental factors connected to the home, teacher, and classroom, peers, and media exposure.

2.2.2 Theory of Fear

According to Holt John (2014), a child's failure in school is a result of their fear. Adults' endless expectations, bewilderment, fear, and other negative emotions all contribute to failure. For a long time, schools and teachers have used fear as a tool to maintain control, enforce discipline, and inspire teachers Fear impairs a child's ability to learn and has a profound impact on how they view, process, and react with the world around them. A mind that is afraid cannot learn. Fear and flour have a close relationship. Throughout their education, children are said to be terrified of failing in school. Holt comes to the conclusion that they are capable of learning. He continues by saying that failing is a humble experience.

2.2.3 Theory of School Effectiveness

Edmonds (2013) came at a different conclusion about the relationship between academic achievement and familial background. According to what is now known as the "school effectiveness research," the type of school that children attend can have a big impact on how well they perform academically. It is asserted that the skills and elements that are closely related to effectiveness are crucial to increased achievement among school-age children. Effective schools are those where the proportion of low-income students who perform well is the same as the proportion of middle-class students who do the same. This is evaluated in terms of subject content taught by the teacher. According to Edmonds (2013), the school itself is the most important factor in student accomplishment.

2.3 Conceptual Framework

A conceptual framework, according to Lukindo (2016) is a method of representation, whereby a researcher depicts the link between variables in a study.

Independent variables **Dependent variables**

ICT usage in teaching and learning science subjects

Performance of science subjects

- Improved grades in sciences

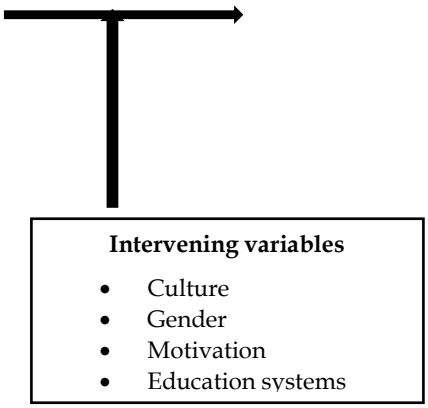

Figure 2. 1 Conceptual Framework

Source: Researcher (2023)

The link between factors is illustrated in Figure 2.1, where the independent variables are made up of the teachers' expertise in using ICT to teach sciences and their prior teaching: Smart classrooms, computers internet connectivity, electricity and the availability of ICT tools in schools. The dependent variables are composed of Improved scored grades in sciences, Increased Students' interest in Sciences, enhancement of research and innovation and the Increased Students' retention and engagement in Sciences. Therefore, the figure indicates that Performance of science subjects is influenced by ICT usage in teaching and learning science subjects. This research Project was rarely on intervening variables such as Culture, Gender, Motivation and incentives and the Education systems.

3.0 Research Methodology

According to Kothari (2013), a research design is a schematic or a plan that explicitly describes the population to be studied, tools, and processes to be used in processing field data. It describes the framework and parameters within which a study was conducted to identify a solution to the issue being researched it outlines the parameters and framework for conducting a study to find a resolution to the problem being investigated. The study is a survey, and the descriptive research design is being used for that reason. It involves a few particular people who must act as respondents. A descriptive study approach is employed for gathering information on people's attitudes, beliefs based on feelings, or any number of educational or social challenges (Alvi,2016). In order to investigate the effect of ICT on students' performance in science classrooms in Nyamasheke district, a descriptive research design was used, since it was appropriate for both qualitative and quantitative research approaches.

3.1 Target Population

The study population, according to Andiema (2015) is any group of individuals who share one or more characteristics essential to the researcher, the general population, or the universal topics that the research addressed. The six public secondary day schools made up the study's sample population, and representatives of administrative staff from every chosen school, ICT science teacher and pupils were chosen. As a result of their extensive exposure to and expertise of the research issue, these offered a significant amount of information. A target population of 225 members was used to select sample size including 197 students of Senior two to Senior five, 6 Science teachers, 12 administrative staff from the selected schools of Nyamasheke district, Rwanda. The research selected a sample of individuals drawn at random from a specified community who accurately reflected the entire population in order to determine the sample design. Yamane simplified formula was used to calculate the sample size.

$n = \frac{N}{1+N(e)^2}$

Where:

n Stands for Sample size

N Stands for size of Population

While **e** denotes precision/accuracy Level (0.05)

Sample calculation for students using Yamane simplified formula is as follows:

$$n = \frac{197}{1 + 197 \times (0.05)^2}$$

$$n = \frac{197}{1 + (197 \times 0.0025)}$$

$$n = 132\ students$$

Simple random sampling was used to select 132 students from a total population of 197 students, Census was applied to determine the 6 head teachers, 6 Directoor of studies and 6 teachers from the total population in the 6 secondary schools in Nyamasheke district, Rwanda. A sample size for the head teachers, Dierector of studies and teachers were not calculated since the total number of them was considered minimal.

Observation checklists, interview guides and surveys/questionnaires containing both open-ended and closed-ended questions were employed as data gathering techniques. To improve triangulation of the results, the researcher primarily collected data using questionnaires and interviews. Through the use of questionnaires and interviews, this project collected both quantitative and qualitative data. Open-ended questions and personal interviews yielded qualitative data that was analysed qualitatively using content analysis and

categorized into themes. The collected data was processed and analysed to produce meaningful, comprehensive, and comprehensible information. The data was tabulated, after which it was analysed using cross tabulation, percentages, bar graphs, pie charts, and frequencies. The tabulation and analysis was carried out via statistical software such as SPSS. In order to establish an empirical association between study variables, these packages allowed the researcher to obtain the mean, range, correlation, regressions, and ANOVA tables, among other statistical outputs.

4.0. Research Findings and Discussions

4.1 Determination of ICT Tools Usage in Teaching and Learning in Public Day Secondary Schools in Rwanda

Objective one of the study determined ICT Tools usage in teaching and learning in public day secondary schools in Rwanda.

Table 4. 1 ICT Tools Usage in Teaching and Learning in Public Day Secondary Schools in Rwanda

ICT Tools Usage	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree	Total	
	%	%	%	%	%	Mean	SD
Usage of ICT tools in schools	10.7	8.9	8.0	37.5	34.8	2.79	1.04
Teacher's skills on ICT usage in teaching sciences	12.5	6.2	7.1	25.9	48.2	3.49	1.02
Teachers 'experience in teaching using ICT tools	0.9	8.0	4.5	55.4	31.2	3.03	1.08
Usage of ICT tools in schools	0.9	4.5	5.4	28.6	60.7	3.00	.98
Students watch video clips in lessons	3.6	5.4	2.6	49.1	39.3	2.58	1.00
Teacher used projector and PowerPoint in lesson	4.5	7.1	28.6	41.1	18.8	1.48	.71
There is internet in the school used for lessons	7.1	6.2	5.4	37.5	43.8	1.67	1.12

Source: Primary Data (2023)

Data presented in Table 4.1 demonstrated that c Usage of ICT tools in schools used in teaching and learning process at moderate level (Mean=2.98, SD= 1.04). The findings indicated that Teacher's skills on ICT usage in teaching sciences are used in teaching and learning process among respondents (Mean=3.49; SD=1.02>0.5). The study demonstrated that Teachers 'experience in teaching using ICT tools are used in teaching and learning process. It has been agreed with a mean of 3.03, standard deviation was 1.049 where respondents strongly agreed with the use of electronic textbooks are used in teaching and learning process. It was indicated that electronic textbooks are used in teaching and learning process are at a very low level of usage and teachers refer to them rarely. According to the respondents, the mean of 3.0 and standard dvt of 0.98 agreed with instructional software use used in secondary schools within NyamashekeDistrict. Students watch video clips in lessons where the means of 2.58 and the standard deviation of 1.00 confirmed the statement. From the finding, it was found that with a mean of 1.48 and sdv of 1.48, respondents evidenced that the teacher used projector and power point in teaching process of the respective lessons among secondary schools in NyamashekeDistrict.

4.2 Level of Students' Academic Performance in Science Subjects that is Due to ICT Usage in Public Day Secondary Schools in Rwanda

The researcher measured students' academic performance in science subjects that is due to ICT usage in public day secondary schools in Rwanda, through improved grades in sciences, increased Students' interest in Sciences and increased Students' engagement.

Table 4. 2 Level of Students' Academic Performance in Science Subjects that is due to ICT Usage in Public Day Secondary Schools in Rwanda

Statements	Strongly Agree	Agree	Not Sure	Disagree	Storngly Disagree	Mean	SD
Improved grades in sciences	49.4	41.9	7.9	0.8	1.01	.67	0.4
Increased Students' interest in Sciences	47.2	41.3	11.1	0.4	1.32	.69	0.2
Increased Students' engagement	85.0	14.2	0.0	0.8	1.04	.43	0.01
Students participate in class discussions	0.0	85.8	12.6	1.6	2.31	.41	1.01
Students complete their homework in time	7.1	6.2	5.4	37.5	43.8	1.67	1.12
Student's average marks at the end of the term exams has been increased	9.8	3.6	1.8	48.2	36.6	1.29	.67

Source: Primary Data (2023)

The results demonstrated that the ways of Improved grades in sciences. This was confirmed by 49.4%, a mean of 0.067 and 10.1 for sdv of 0.67. 47.2% strongly agreed that the management of students, Increased Students' interest in Sciences is effective on a mean of 1.32 and sdv of 0.43. Moreover, 85.0% strongly disagreed that there is an Increased Students' interest in Sciences Increased Students' engagement with a mean of 1.04 and adv. Of 0.43. Moreover, 85.6% disagreed with the participation of students in classroom with a mea of 2.31 and sdv of 0.41. Therefore, 43.8% strongly agreed with students complete their homework in time with a mean of 1.67 and sdv of 1.12. Finally, 48.2% of respondents agreed that the student's average mark at the end of the term exams has been increased with a mean of 1.29 and sdv of 0.67.

4.3 Effect of Iformation and Communication Technology Usage on Students' Academic Performance in Science Subjects in Public Day Secondary Schools

The ICT tool usage was measured using Usage of ICT tools in schools, Teacher's skills on ICT usage in teaching sciences, Teachers 'experience in teaching using ICT tools.

Table 4. 3 Correlation between Information and Communication Technology Usage on Students' Academic Performance in Science Subjects in Public Day Secondary Schools

		Improved grades in sciences	Increased Students' interest in Sciences	Increased Students' engagement
Usage of ICT tools in schools	Pearson Correlation	.843**	.871**	.957**
	Sig. (2-tailed)	.000	.000	.000
	N	156	156	156
Teacher's skills on ICT usage in teaching sciences	Pearson Correlation	.852**	.873**	.949**
	Sig. (2-tailed)	.000	.000	.000
	N	156	156	156
Teachers 'experience in teaching using ICT tools	Pearson Correlation	.962**	.934**	.863**
	Sig. (2-tailed)	.000	.000	.000
	N	156	156	156

Source: Primary Data (2023)

Results in Table 4.3, evidenced that Usage of ICT tools in schools, and the improved grades in sciencesm increased produced Pearson correlation coefficient r= 0.843 between Usage of ICT tools in schools, and increased Students' interest. It was 0.871 between Usage of ICT tools in schools, and increased students' engagement. This shows that the relationships were all positive and statistically significant. Each of these elements significantly increase improved grades in sciencesm increased Students' interest in Sciencesm and increased students' engagement when they are improved. Furthermore, the study findings evidenced that the correlation between Teacher's skills on ICT usage in teaching sciences on one hand and Improved grades in sciences on the other hand was 0.852**, the correlation between Teacher's skills on ICT usage in teaching sciences and Increased Students' interest in Sciences was 873** and correlation between Teacher's skills on ICT usage in teaching sciences and the Increased Students' engagement was .949**.Moreover, electronic textbooks is correlated with improved grades in sciences .962**, it has a significant relationship with Increased Students' interest in Sciences was .934**, wit increased Students' engagement was at .863**.

Regression Analysis between Independent Variable and Improved grades in sciences

This Table 4.4 gives a model summary between variables improved grades in sciences

Table 4. 4 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.736a	.542	.512	.24706

A. Predictors: Constant), Usage of ICT tools in schools,Teacher's skills on ICT usage in teaching sciences,Teachers 'experience in teaching using ICT tools

Source: Primary data (2023)

Information presented in Table 4.4 indicated that the value of adjusted R Square was 0.512 and demonstration that there is a change of .542 on Improved grades in sciences owing to the fact that a variation in Usage of ICT tools in schools,Teacher's skills on ICT usage in teaching sciences,Teachers 'experience in teaching using ICT tools .

Table 4.5 Analysis of Variance (ANOVA)

Model		Sum of Squares	df	Mean of Square	F	Sig.
1	Regression	5.565	4	1.113	18.234	.000a

	Residual	4.700	152	.061
	Total	10.265	156	

a. Predictors: (Constant), Usage of ICT tools in schools,Teacher's skills on ICT usage in teaching sciences,Teachers 'experience in teaching using ICT tools

b. Dependent Variable: Improved grades in sciences

Source: Primary Data (2023)

Information presented in Table 4.5 felt that the value of adjusted R Square was 061 and demonstration that there is a change in 5.565 on improved grades in sciences due to the change in Usage of ICT tools in schools,Teacher's skills on ICT usage in teaching sciences,Teachers 'experience in teaching using ICT tools.

Table 4.6 Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.835	.077		10.814	.000
	Usage of ICT tools in schools	.037	.056	.162	.655	.514
	Teacher's skills on ICT usage in teaching sciences	.113	.062	.416	1.809	.074
	Teachers 'experience in teaching using ICT tools	.096	.034	.402	2.813	.006

a. Dependent Variable: Improved grades in sciences

Source: Primary Data (2023)

Finding in Table 4.6 revealed that holding independent variables constant (Usage of ICT tools in schools ,Teacher's skills on ICT usage in teaching sciences,Teachers 'experience in teaching using ICT tools) to a constant zero, Improved grades in sciences would be at .110, and, cost efficiency at 064 can improve ICT tools use limited by a factor of 0.70.

Regression Analysis between Independent Variable and Increased Students' interest in Sciences

The results are presented in Table 4.7 gives a model summary between independent variables and Increased Students' interest in Sciences

Table 4.7 Model Summary

Model	R	R Square	Adjusted R Square	Std.Error of the Estimate
1	.609[a]	.371	.330	.40657

a. Predictors: (Constant), Usage of ICT tools in schools,Teacher's skills on ICT usage in teaching sciences,Teachers 'experience in teaching using ICT tools

Source: Primary data (2023)

From Table 4.7, the contribution of the change made R was 330 shows that the change of 373 of R Square delivered to or within Increased Students' interest in Sciences due to changes in the independent variable (Usage of ICT tools in schools, Teacher's skills on ICT usage in teaching sciences, Teachers 'experience in teaching using ICT tools).

Table 4.8 ANOVA

Model		Sum of Squares	df	Mean of Square	F	Sig.
1	Regression	7.513	4	1.503	9.090	.000[a]
	Residual	12.728	152	.165		
	Total	20.241	156			

a. Predictors: (Constant), Usage of ICT tools in schools,Teacher's skills on ICT usage in teaching sciences,Teachers 'experience in teaching using ICT tools

b. Dependent Variable: Increased Students' interest in Sciences

Source: Primary data (2023)

Usage of ICT tools in schools, Teacher's skills on ICT usage in teaching sciences, Teachers 'experience in teaching using ICT tools. The determined sum of square 1.503 and total mean square was 12.728 at the regression. The significance was 9.090. This demonstrated that the model was pertinent and independent variable, all have a positive impact Increased Students' interest in Sciences.

Table 4.9 Regression Coefficient

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.000	.127		7.867	.000
	Usage of ICT tools in schools	.291	.092	.912	3.156	.002
	Teacher's skills on ICT usage in teaching sciences	.387	.102	1.018	3.779	.000
	Teachers 'experience in teaching using ICT tools	.072	.056	.213	1.276	.206

a. Dependent Variable: Increased Students' interest in Sciences

Source: Primary data (2023)

The finding revealed that holding independent variables constant (Usage of ICT tools in schools ,Teacher's skills on ICT usage in teaching sciences, Teachers 'experience in teaching using ICT tools) to a constant zero, Increased Students' interest in Sciences would be at .116 while the most significant p value was .056. Therefore, an increase in ICT tools stimulate suitable radio by a factor of 0.11 standardized significance at teaching procedure.

Regression analysis and Increased Students' engagement

Table 4.10 gives a model summary between independent and Increased Students' engagement in secondary schools of NyamashekeDistrict. More details were given in Table 4.10.

Table 4.10 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.950[a]	.903	.897	.15947

a. Predictors: (Constant), Usage of ICT tools in schools, Teacher's skills on ICT usage in teaching sciences, Teachers 'experience in teaching using ICT tools.

Source: Primary data (2023)

Information presented in Table 4.10, the value of adjusted R Square was 0.897 and demonstration that there was a variation of .903 enhanced Increased Students' engagement owing to adjustment in the independent variable (Usage of ICT tools in schools, Teacher's skills on ICT usage in teaching sciences, Teachers 'experience in teaching using ICT tools.).

Table 4.11 ANOVA

Model		Sum of Square	df	Mean Square	F	Sig.
1	Regression	18.283	4	3.657	143.785	.000[a]
	Regression	1..958	152	.025		
	Total	20.241	156			

a. Predictors: (Constant), Usage of ICT tools in schools, Teacher's skills on ICT usage in teaching sciences, Teachers 'experience in teaching using ICT tools.

b. Dependent Variable: Increased Students' engagement

Source: Primary data (2023)

The calculated value was 3.675.722 pertinence degree at the regression level while at the same level was 0.25 and mean square was 18.283. The aforementioned felt that the general model to be statistically significant and independent variable and all had positive impact of the level of: Increased Students' engagement among secondary schools in NyamashekeDistrcit.

Table 4. 12 Regression Analysis

		Unstandardized Coefficients		**Standardized Coefficients**		
Model		**B**	**Std. Error**	**Beta**	**t**	**Sig**
1	(Constant)	.754	.050		15.118	.000
	Usage of ICT tools in schools	.398	.036	1.247	10.998	.000
	Teacher's skills on ICT usage in teaching sciences	.116	.040	.305	2.884	.005
	Teachers 'experience in teaching using ICT tools	.106	.022	.315	4.803	.000

a. Dependent Variable: Increased Students' engagement

Source: Primary data (2023)

The finding revealed that holding independent variables constant (Usage of ICT tools in schools, Teacher's skills on ICT usage in teaching sciences, Teachers 'experience in teaching using ICT tools) to a constant zero, would be at 0.398 restricted by an element at 0.49 significantly correlated with the level of increased the level of Interpersonal relations in secondary schools of NyamashekeDistrict.

4.4 Factors Intervening in the Use of Information Communication Technology Tools

The fourth objective determined Factors Intervening in the Use of Information Communication Technology Tools.

Table 4. 13 Information Communication Technology tools used

Factors for ICT use	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree	Total	
	%	%	%	%	%	Mean	SD
Avaialability of ICT Tools	10.7	8.9	8.0	37.5	34.8	2.79	1.04
Usability of ICT tools	12.5	6.2	7.1	25.9	48.2	3.49	1.02
Internet connectivity	0.9	8.0	4.5	55.4	31.2	3.03	1.08
Teacher ICT skills in using tools	0.9	4.5	5.4	28.6	60.7	3.00	.98

Source: Primary Data (2023)

Data presented in Table 4.13 demonstrated that ICT Tools are available at moderate level (Mean=2.98, SD= 1.04). The findings indicated that ICT tools are usable in teaching and learning process among respondents (Mean=3.49; SD=1.02>0.5). The study demonstrated that the availability of internet connectivity. It has been agreed with a mean of 3.03, standard deviation was 1.049 where respondents strongly agreed with the use of internet connectivity. According to the respondents, the mean of 3.0 and standard dvt of 0.98 agreed with Teacher ICT skills in using tools as a factor intervening in the use of ICT tools.

5.0 Discusion of Findigns

The present section presents data collected on the research subject based on the specific objectives of the study. Specific objectives were the following: to identify the ICT Tools usage in teaching and learning in public day secondary schools in Rwanda, to analyse the students' academic performance in science subjects that is due to ICT usage in public day secondary schools in Rwanda, and to determine the effect of Iformation and communication technology usage on students' academic performance in science subjects in public day secondary schools as well as factors intervening in the use of information communication technology tools.

5.1 Determination of ICT Tools Usage in Teaching and Learning in Public Day Secondary Schools in Rwanda

Objective one of the study determined ICT Tools usage in teaching and learning in public day secondary schools in Rwanda. The most commonly technology material tools used included Usage of ICT tools in schools ,Teacher's skills on ICT usage in teaching sciences,Teachers 'experience in teaching using ICT tools . Findings from the present study did not contradict with the observation of Pedrosa; *et al*. (2016) carried out a survey in USA and found that as the use of ICT helped a minority of teachers to apply a more constructivist pedagogy, it has not changed the way of teaching for a majority of secondary subject teachers. In this regard, teachers accepted that in the right conditions, ICT became a precious teaching tool that has effects on student's success in classroom and also on their external performance. In the same vein, the results have been found by Andiema (2015) in their view on the effects of ICT in Europe. Teachers emphasized that ICT use has improved collaboration and facilitated them to share ideas and teaching tools. Concerning the pedagogical practices, those teachers continued to use traditional approaches where ICT is taken as a tool to support their didactic approaches. Hence, researchers evidenced that teachers are exploiting the innovative potentiality of ICT and students are passively involved in capacity building.

5.2 Students' Academic Performance in Science Subjects that is due to ICT Usage in Public Day Secondary Schools in Rwanda,

The researcher measured students' academic performance in science subjects that is due to ICT usage in public day secondary schools in Rwanda, through improved grades in sciences, increased Students' interest in Sciences and increased Students' engagement. The study findings from the present research concur with the work of Blazar and Kraft (2017) who denoted that teachers who use ICT can share learning tools in different ways: ICT helped teachers and learners to use video system to transmit information and television programs thought all infrastructure of the school even between schools of the same region. This way of working can minimize expenses and increase teaching quality in secondary school education specifically in schools without sufficient teaching tools. In the same context of Drossel, *et al*., (2017) where they found that even though teachers were with the student based beliefs, they were unable to incorporate constructivists teaching with ICT utilization and this reveals contradictions between teacher's pedagogical opinions and teaching activities. The study showed that most teachers, regardless of their pedagogical beliefs in favour of ICT integration, were still utilizing lecture based teaching activities when integrating ICT. Finaly, Trucano (2015), in the knowledge maps, carried out a survey on the effective of using ICT in education in under development countries.

5.3 Effect of Information and Communication Technology Usage on Students' Academic Performance in Science Subjects in Public Day Secondary Schools

The ICT tool usage was measured using Usage of ICT tools in schools, Teacher's skills on ICT usage in teaching sciences, Teachers 'experience in teaching using ICT tools. On the other hand, performance of students was assessed through improved grades in sciences, Increased Students' interest in Sciences and Increased Students' engagement. Results concur with the study of Nazir (2015) who established teachers should be trained on the TPACK framework where they can share experience on how to choose appropriate technological tool for a selected content by using this tool in teaching and learning process with the modification of teaching relying on chosen instrument. It is a framework that helps to establish how to teach with technological devices that permits teachers to combine content, pedagogy and technology. It did not contradict Nwigbo and Madhu (2016), conducted in Bungoma District of Kenya, and admitted that when you want to effectively adopt any educational technology, you should facilitate teachers to have complete confidence in them and the ability to use it in classroom instruction. To evaluate the motivation provided by technology in the classroom Pedrosa, *et al*., (2016) assessed the influence ICT

on students' motivation and achievement in English lessons. He found that in a class, 88 percent of learner confirmed that use ICT complete English lessons more exciting than how it was expected.

5.4 Factors Intervening in the Use of Information Communication Technology Tools

The fourth objective determined Factors Intervening in the Use of Information Communication Technology Tools. Data demonstrated that ICT Tools are available at moderate level (Mean=2.98, SD= 1.04). The findings indicated that ICT tools are usable in teaching and learning process among respondents (Mean=3.49; SD=1.02>0.5). The study demonstrated that the availability of internet connectivity. It has been agreed with a mean of 3.03, standard deviation was 1.049 where respondents strongly agreed with the use of internet connectivity. According to the respondents, the mean of 3.0 and standard dvt of 0.98 agreed with Teacher ICT skills in using tools as a factor intervening in the use of ICT tools. Findings from the present study did not contradict with the observation of Pedrosa, *et al*. (2016) carried out a survey in USA and found that as the use of ICT helped a minority of teachers to apply a more constructivist pedagogy, it has not changed the way of teaching for a majority of secondary subject teachers. In this regard, teachers accepted that in the right conditions, ICT became a precious teaching tool that has effects on student's success in classroom and also on their external performance.

5.0 Conclusion and recommendations

Relying on results presented and discussed in the fourth chapter, researcher attempted to provide concluding remarks. In this regard, objective one, this concludes that the research felt the The most commonly technology material tools used included Usage of ICT tools in schools, Teacher's skills on ICT usage in teaching sciences, Teachers 'experience in teaching using ICT tools.From the second objective and question, the researcher concludes that a big number of teachers were able to improve their classroom teaching. The results demonstrated that the ways of classroom teaching has been improved. Improved grades in sciences, increased Students' interest in Sciences and increased Students' engagement.To the third objective, the researcher concluded that the majority of ICT tools used are more like to significantly affect the level performance of stuentents in secondary schools located in NyamashekeDistrict. This research concludes that relationships are all positive and statistically significant. Each of these elements significantly increases students' performance when they are improved. This shows that the relationships were all positive and statistically significant. Each of these elements significantly increases improved grades in sciencesm increased Students' interest in Sciencesm and increased students' engagement when they are improved. Moreover, electronic textbooks are correlated with improved grades in sciences. Has a significant relationship with Increased Students' interest in Sciences was with Students' engagement.To the fourth objective, the researcher concludes that ICT Tools are available at moderate level (Mean=2.98, SD= 1.04). The findings indicated that ICT tools are usable in teaching and learning process among respondents (Mean=3.49; SD=1.02>0.5). The study demonstrated that the availability of internet connectivity. It has been agreed with a mean of 3.03, standard deviation was 1.049 where respondents strongly agreed with the use of internet connectivity. According to the respondents, the mean of 3.0 and standard dvt of 0.98 agreed with Teacher ICT skills in using tools as a factor intervening in the use of ICT tools. In this regard, teachers accepted that in the right conditions, ICT became a precious teaching tool that has effects on student's success in classroom and also on their external performance.

From this study, a number of recommendations were made possible: reconsidering concluding remarks from the study findings and information argued that the author attempted to make some recommendations to the study.

Public institutions must ensure that budgeting could focus on improving electronic-libraries in education secondary. The ministry of education has to seek enough financial means to stimulate teachers to have access to ICT tools that are capable to increase their teaching success..School principals are recommended to organize in service training and capacity building in order to enhance knowledge related to the use of ICT tools. Head Teachers would make awareness to parental involvement as well as the government on the role of increasing availability, accessibility and usability of suitable ICT tool usage in public secondary schools and that high or low teachers performance would not rely on the content that they obtain in classrooms as well as accessibility to ICT tools for future revision themselves. Teaching staff members must attempt on the generation of simple aids in order to see what they are discussing about in the lessons. Local communities must motivate parents to participate actively to the provision ICT tools use in public and day schools to improve teaching success.

The research focused on ICT tool usage and performance of students; however, the researcher did not focus on effectiveness and suitability of those tools. Therefore, there is a need to carry out a research on effectiveness of ICT tools in enhance teaching and learning outcomes. However, it will be necessary to carry out further studies on: the impact of ICTs to educational success of students in secondary school, a study on other strategies adopted to ameliorate teaching specific subjects in public secondary schoolsA study on variety, types and adequacy of ICT tools in both private and public secondary schools is need to be undertaken.

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