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Teachers and Students Perception of Smart Classrooms usage in Rwanda: A case of secondary schools of Huye District.

By

Protogene MUHIRE

Reg. No: 219000037

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Supervisor: Dr. Jean Francois MANIRAHO

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DECLARATION

I, hereby, declare that this dissertation title: "**Teachers and Students Perception of Smart Classrooms usage in Rwanda: A case of secondary schools of Huye District**" is my original and has not been presented in other University, College, or Institute for award of any other degree.

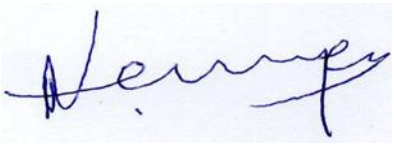
Over and above, the works by others which served as sources of information were declared on the reference list.

Student's name **Signature**

MUHIRE Protogene

Supervisors

Dr. Jean Francois MANIRAHO 



Assoc.Prof. NDABAGA Eugene

APPROVAL

I, **Dr. Jean Francois MANIRAHO**, to the best of my knowledge, hereby confirm that this dissertation titled "**Teachers and Students Perception of Smart Classrooms usage in Rwanda: A case of secondary schools of Huye District**" is the original work of Mr. MUHIRE Protogene and was done under my supervision.

Signature  Date 20/05/2022

Supervisor's Names: Dr. Jean Francois MANIRAHO

DEDICATION

To my beloved wife, NDUWAYO Frida

My daughter, UMUHIRE Nellie Jessy and my son MUHIRE Bless Mike

My parents, BAYASEME Adrien and MUKARIVUZE Suzanne

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MUHIRE Protogene

ABSTRACT

The purpose of this study was to investigate the perceptions of teachers and students toward Smart Classrooms usage in Rwanda: A case of secondary schools of Huye District. To achieve the above-mentioned purpose, the study answered the questions related to teachers and students' perceptions towards smart classrooms in secondary schools, teaching and learning activities teachers perform in the smart classrooms and the possible challenges regarding smart classrooms as well as related mitigating strategies. Previous studies revealed the mismatch between what teachers valued as important and what they practiced. Teachers may value ICT, but that does not necessarily mean that they will practice it. To this end, the teachers' adoption of Smart classroom depends on teachers' predispositions and understanding of their roles in ICT like ICT support training, technical and teaching support, ICT literacy network and various other circumstances and influences. Also, some researchers found that traditional class is more effective than smart classroom due to inefficient Smart classroom teachers, time consuming, learners who do not have opportunity to take more or less time to share or construct knowledge in the classroom and Smart classroom instructions that are not suitable for all students, (Jena, A K 2013). On the other hand, research revealed that teachers and students need schools and classrooms to be equipped more, starting with computers with internet, projectors, and Smart boards. Furthermore, the types of interactive curriculum and applications online is far more motivating and engaging for students than old school paper and pen activities. Smart classroom increases learners' engagement hence teachers use it for searching teaching and learning materials, preparation of lesson notes as well as sharing resources and experiences. Furthermore, researchers revealed that lack of electricity and Internet connectivity**,** ICT resources not fully utilized and theft of ICT equipment and teachers' attitude toward smart classrooms are the key barriers to effective use of Smart classroom. Several literatures accessed so far were only focusing on the management of smart classrooms and its effectiveness on learners' performance in the context of Rwandan, but no available study investigated on perceptions of teachers and students for Smart Classroom and its usage in Rwanda, as it is the new strategy adopted by the Ministry of Education to strengthen ICT in all levels of Education.

To find out the answers to the three research questions mentioned above, the study followed a convergent parallel mixed methods design which involved a concurrent parallel collection of both quantitative and qualitative data, a separate data analysis, and an integration of both quantitative and qualitative results for a thorough understanding of the investigated problem. In the current study, a sample of 20 head teachers and 20 deputy head teachers in charge of studies were selected

purposively while 170 teachers and 393 students were selected using Slovin's formula for sample size determination. Qualitative data were analyzed through Microsoft Excel and SPSS by descriptive statistics. Besides, qualitative data analysis was followed by thematic analysis.

During the analysis the respondents said that Smart classroom help them to prepare different school activities such as assignments, developing lesson plan and other school documents, learning form expert teachers the updated pedagogical skills, and searching for various information in general. Various activities like create materials for students, post information to website to assist students learning, listening activities, speaking activities, performing tasks required by REB, MINEDUC, were found during the data analysis, challenges such as insufficient technological devices, unskilled teachers, short time for using Smart classrooms and unskilled students since some students don't have basic knowledge on how to use a computers and other different technological devices which can help them in learning process were sorted out.

During the focused group discussion, deputy head teachers in charge of studies mentioned that Smart Classrooms are being used as a tool of learning for both students and teachers, since they intervene in downloading videos, images and documents related to the curriculum and learning teaching materials. Furthermore, learning from expert teachers and students, computer skills learning activities, and doing report easily, among others, have been highlighted.

This study recommended that clear guidelines and timetable related to the proper use of smart classrooms must be put in place to avoid misuse of Smart classrooms for both teachers and students, as teachers confirmed that there are no clear guidelines governing smart classrooms at school level. additionally, teachers must incorporate smart classrooms in their lessons to equip students with competencies and skills helping them to be competitive worldwide. Finally, school management should be reformulated hence headteachers blamed MINEDUC and REB to give hard punishment to the leaders who miss computers and other technology devices without an intensive investigation.

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ACRONMYS

BBC: British Broadcasting Corporation

CBAM: Concerns-Based Adoption Model

DOI: Diffusion of Innovation Theory

DHT: Deputy head teacher in charge of Studies

FGD: Focused Group Discussion

HEFCE: Higher Education Funding Council

ICT: Information and Communication Technology

KMS: Knowledge Management System

LMS: Learning Management System

MINEDUC: Ministry of Education

MINEDUC: Ministry of Education

QEAC: Quality Education Awareness Campaign

REB: Rwanda Basic Education

SPSS: Statistical Packages for Social Sciences

TVET: Technical Vocation Education Training

UK: United Kingdom

UNESCO: United Nations Educational, Scientific and Cultural Organization

USA: United State of America

VLE: Virtual Learning Environment

CHAPTER ONE: GENERAL INTRODUCTION

1.0. Introduction

This chapter discusses some critical issues related to the background of the problem of this topic. It presents a detailed background of the research topic by giving an overview on the perceptions of teachers and students towards Smart classroom and its usage in school activities. It also highlights the problem statement, the purpose of the study, research objectives, research questions, hypothesis, and the significance of the study. It also put emphasis on the rationale behind this research and its significance on the field of education, provided a conceptual framework and operational definitions that was used in this research.

1.1. Background of the problem

It is worldwide believed that the economic growth of any country depends on the quality of education children get from the schools. Rulinda.et all (2013) stressed that education is the greatest vital gift a country can give to its children. Indeed, Abdinoor.at all (2012) added that education is one of the essential components contributing to socio-economic and political development as well as improvement in the human society. From these perspectives, education stays a cornerstone in the holistic development of any nation.

As stipulated by the constitution of Rwanda of 2015 in article 20, education is the right of every Rwanda (Official Gazette no Special of 24/12/2015). The above constitution goes on by emphasizing that privilege to learning is assured to everyone with conditions stipulated by the law and goes on by emphasizing that factors physical space, classroom needs and supplies, computers should be in place to teachers in providing quality of education to Rwandan children.

It is worth to note that as (MINEDUC, ESSP 2003) stated it, “education is a fundamental human right and indispensable to guarantee that all Rwandese attain their full potential”. In this context, education and training are the pillar and keystone for economic development and poverty reduction strategy in Rwanda.

The Rwandan government considered two main objectives for the education system which are to equip all Rwandan people with all the required skills and values to become good citizens and to boost the quality of human life by all levels of education system.

Grounded in this direction, several initiatives in education have taken place to improve both access and quality of education at all levels and they are in line with the second specific objective of Rwandan education policy which is to improve the quality and relevance of education (MINEDUC, ESSP 2003). All initiatives taken in Rwandan education system require more commitment and greater performance from both teachers and students. Despite all Government of Rwanda initiatives to equip Rwandan schools with "Smart Classrooms" as an effective digital solution to enhance students learning, the appropriate utilization of those IT infrastructure remains an issue. Consequently, there is a need of strong investigation related to how teachers and students perceive this good initiative of establishing classrooms equipped with laptops connected to the internet and a projector.

Technology is changing our today's vision, work, and life. In 1990s, the primary target for modern technologies were in education and the researchers were keen to see how their discoveries transformed the education people used to know (Vail, 2003). Although the integration of technology into schools is not easy due to the scarcity of financial resources in developing countries. Driscoll (2002) asserted that new way of teaching is necessary to attract student's achievements and proposed four major principles for teachers as they are thinking of technology integration: (1) education take place in context, (2) education is not passive rather, active, (3) education is part of social, and (4) education provide a reflection. From this context, ICT is being used not only as technology of information and communication but also as a part of set of courses and transmission strategy for students. John Dewey (2010) talked *"if learners of today are being taught as yesterday learners taught, we obliterate our children for tomorrow"*. Therefore, it is needed to integrate student-teacher technology as one. Traditional ways of teaching were on putting information on chalkboards and walls, which is completely different from the establishment of Smart Classroom. On the other hand, technology-based classroom does not mean that it is deracinating traditional teaching methodology but mixing it with new (Hemant & Sharma, 2016).

Block et al, (2015) defined Smart Classroom as the mixture of innovation and technology utilized at the teacher's work area and before the classroom to enhance the teaching and learning process. Smart classroom has seven concepts such as adaptability or flexibility, comfort, multiplicity, connectivity, openness as well as personalization.

Most of today's students are familiar with digital devices and are usual categorized under the net generation. Thus, the net generation students have style of learning, which is different from the

students in the past time since they desire to learn at their own rhythm. In addition, they are happy with the environment under which digital tools are used for testing, lectures, and assignment. School time is utmost interesting for these students when it includes collaboration, or social networking, (Skipton, 2006).

Many American universities and colleges have used millions of dollars in equipping classrooms with digital tools, but the investments do not necessary affect positively teaching and learning activities; hence technology does not replace good teaching skills, (Young, J. 2004). Educational technology is most powerful when used as an instrument for problem solving, conceptual development and critical thinking but if integrated inappropriately it can backfire in a way that it destabilizes all three skills, (Briggs, 2014). To this end, the use of technology in the classroom can sometimes lead to worse academic performance, when it is use in the capacity that students learn from computers instead of learning with technology. From these concepts learning from computer simply mean the computer assists as information delivery system whereby it presents a student with basic knowledge. By contrast, learning with technology means that technology is used as a tool that can be harnessed to a variety of goals in the learning process (Briggs, 2014).

In the Europe, smart education was understood and adopted as an education system implementing a fully integration of technology tools that function over the internet connectivity with the atmosphere and the procedure of teaching and education for people to obtain the essential knowledge, skills, capabilities, and proficiencies. The reasons for the establishment of Smart education ideas included but not limited to:

- Technological since it will intervene in transformation of technologies,
- Social with the purpose of helping new generation, creating digital society, bringing new education, and improving competences
- Economical with the projection of developing digital economy. For the education domain Smart education has been promoted with the main principles namely the most up to date information for education programs and its real time update paradigm, organization of self-cognitive research and project activities of students, execution of the learning activities in a conducive learning environment, student's collaboration with the skilled community, individualization of learning and variety of education activities. (Barbas, at.al 2021).

Many African countries already launched smart classrooms to overcome traditional education challenges in secondary schools. Mens (2016) asserted that the concept smart classroom has been

initially proposed in the year of 2010 during the implementation of Kenya-The Netherlands project intended to promote TVET Education. Indeed, in 2015 the Ministry of Education, Science and Technology in collaboration with Devotra reworked on the concept of smart classroom. Consequently, the idea of smart classroom has been exclusively rationalized based on the most recent ideas and technologies on hand. Osinbajo (2018) revealed that the Nigerian government is propelling a smart classroom and digital training program all over the country as a feature of government's endeavors to rejuvenate the instruction segment through ICT. With that initiative, the aim is to utilize technology to drive the attainment of the Sustainable Development Goals 4, 8, and 9 about Quality Education, Economic Growth just as industry and Innovation, in this way making occupations through the E-Learning Platforms, Educational Software and Apps just as different advancements.

The blueprint of Rwanda Vision 2050 emphasizes on transforming Rwanda into upper middle income by 2035 and high-income country by 2050. From this view, learning with technology will be an essential element that will drive the transformation of Rwanda to high-income country hence its economy will be based on knowledge as well as intellectual capital. To this end, new pathway of improving living standards of the Rwandan citizens has been set in all levels. The key aspects to consider include economic competitiveness reinforced by modern technology.

The usage of Technology in education is seen as a crucial weapon to enhance the quality of learning outcomes that are important to the economic and social development of Rwanda. It is also in line with the ESSP 2018/19 to 2023/24 which is to equip primary, secondary, TVET, and high education institutions with Smart Classrooms and enhance teaching skills in ICT across all levels of education. From this perceptive, MINEDUC has tasked secondary schools to quickly adopt a new initiative of establishing smart classrooms as a pathway of raising the quality of education and further achieving to the highest quality and standard of living among Rwandan citizens. Therefore, the initiative of equipping classrooms with ICT devices, is introduced in the context that education technology will be a driving instrument which will change significantly Rwandan education system, through the digitalization of the content of all subjects, making digital library available to everyone, as well as reducing the budget for printing and transporting textbooks. (Karuhanga, 2018).

Mbonyinshuti (2018) declared that having classrooms equipped with computers, internet connectivity, smart board, and projector among others, remains a government urgency and important in education domain. According to Ndayambaje, I. (2018) there is a hop that all public and government aided schools will have been connected by 2020. The intention of smart classroom is to integrate technology into numerous aspects of education system and revolutionize learning and teaching processes. MINEDUC (2016) through ICT in education policy, seeks to incorporate technology across all corners of education, namely lesson preparation, lesson delivering, students' assessment, research, among others. The establishment of smart classroom is one of the ways to bring about positive change in imparting knowledge and competencies to students hence they would be taught using various resources instead of using single book.

1.2.Statement of the problem

For the best management, school environment remains a paramount corner that can strengthen students' performance. Educational specialists declare that the quality of education not only depends on the teachers as reflected in the performance of their duties, but also in the effectiveness of coordinating the school environment. However, the six consecutive quality education and enhancement campaigns reported the insufficiency of facilities in school environment (Tabaro, 2014).

Recently, the government of Rwanda, through the Ministry of Education has launched the smart classrooms' initiative to complete the traditional teaching that was concentrated on face-to-face teaching approach. The initiative requires the establishment of information and communication technology facilities within the learning environment to facilitation the teachers and students' obligations, while in traditional education also teaching and learning materials was a big challenge. This is evidenced by fifty-seven secondary schools closed for failure to provide conducive learning environment (The East African, 2018).

Besides, a tremendous effort has made to equip schools with computers, internet connectivity, screen projectors and white boards across the country with aim of facilitating teaching and learning process. While government of Rwanda put more effort in providing materials and other equipment that can accelerate the use technology in teaching and learning, many headteachers are not motivated to let teachers exploit smart classrooms as it was designed by government of Rwanda, but computers can be in store without being used, (Mushimiyimana,2021). In addition, the report

from quality education enhancement awareness campaign (QEAC) phase IV and other school inspections revealed that ICT facilities in some schools are not effectively being used. Some smart classrooms are kept as idle assets, no timetable for using smart classroom while it should be available both for specified classes and teachers, 300 computers are damaged and not yet repaired while 92 computers are stolen. Furthermore, some teachers are still using outdated teaching practices despite the availability of technology resources, while others use it in conducting learning and teaching process. As revealed by Wang. At. all (2022), the effective use of devices found in the smart classroom in all levels of education depends on school leaders' will, teachers' interest, ability, and knowledge about it. Also, Charles (2015) revealed that teachers and students' perception plays a substantial role in the integration of ICT devices in teaching and learning process. He also stressed that negative perception toward technology leads to poor use of smart classroom in teaching. Could this poor utilization of technology devices be linked with resistance and negative attitude towards Smart classroom or there are other factors that are hindering the effective utilization of Smart Classroom? Is there any suggestion from teachers and students that can contribute to the proper use of smart classroom in teaching and learning process? This study therefore seeks to investigate the teachers and Students Perception of Smart Classrooms usage in Rwanda, with the purpose of exploring whether smart classroom is perceived as valuable tool that can lead to the effective teaching and learning process and vice versa.

Objectives of the study

1.3.1 General objective of the study

The main purpose of this study is to explore the teachers and students' perceptions regarding the use of smart classroom initiative in selected secondary schools of Huye district.

1.3.2 Specific objectives

i. To assess the teachers and students' perceptions towards smart classrooms in secondary schools

ii. To find out teaching and learning activities that teachers and students perform in the Smart classrooms.

iii. To find out possible challenges regarding smart classrooms utilisation and related mitigating strategies

1.3.Research Questions

The following are research questions of this study:

i. What are the teachers and students' perceptions towards smart classrooms in secondary schools?
ii. What categories of learning and teaching activities do teachers and students perform during smart classrooms usage?
iii. What are the possible challenges regarding smart classrooms and related mitigating strategies?

1.4.Research hypotheses

Research predicts that:

a) Teachers and students have positive attitudes related to the benefits of Smart classroom in their teaching practices and accept it as an effective digital solution aiming at enhancing teaching and learning process by helping students understand concepts better.
b) Teachers and students understand different activities that they can use to encourage smart classroom usage in their daily activities.
c) There are challenges to smart classroom usage that teachers and students face, and the strategies to adopted to fix those issues.

1.5.Significance of the study

It is significant to comprehend teachers and students' views toward the smart classroom usage in Rwanda, and how they remark their role in the context of Rwandan education system, since they are considered as the primary implementers and agents of change, who eventually help in directing formal education. Aileen Kennedy (2005) said that the purpose of describing the significance of the study is to convey the importance of the problem under the study to the relevant audiences that may profit and using the findings of the study. This study raised up the perceptions of teachers and students regarding the use of smart classrooms in the existing conditions that surround teachers' practices, it also dealt with the types of activities that teachers perform in the smart classrooms, as well as challenges regarding smart classrooms utilisation and related mitigating strategies.

In the same vein, the findings of this study are very crucial for different educational stakeholders to take appropriate decision at different levels:

The government of Rwanda will be informed on the hindrances to the use of smart classroom in educational process and suggested mechanisms leading to the successfulness use of smart classrooms in teaching and learning process.

The Ministry of education and its implementing agencies will make a critical judgement on the effectiveness use of smart classroom by fulfilling the needs and expectations of the implementers and standardizing existing smart classrooms to support interactive learning. Indeed, it will help to clarify the teachers' capacity building needed for proper use of smart classrooms.

For head teachers the research will be helpful in constructing knowledge related to the viewpoints of teachers and students, and the knowledge will be used to fix the challenges hindering the proper use of smart classrooms in their respective schools.

Furthermore, teachers and students will benefit from this research findings by identifying the areas where they have strengths and areas which need improvement and mention their suggestions for effective use of smart classroom.

For research himself will improve his knowledge in relation to the findings of the problem under investigation. Also, it will help future researchers to have more knowledge related to smart classrooms in Rwandan education system.

1.6: Theoretical framework.

Theory and research are interconnected. Theory stipulates a conceptual framework for research, and research intervenes to the development of theory in return (Pant. At all 2012)

Theory development is one important aspects of this research since the preliminary stimulus of research is to generalize the results of the study to the whole population and connect the new knowledge to the existing one. This means that research is technique used to gather data desirable for the theory. Existing theory or a series of theories provide foundation for the theoretical framework within which to position research. A theory is explained as a set of interconnected concepts, explanations and suggestions that show a logical view of phenomena by clarifying

relatives among variables with the intent of explicating and anticipating the phenomena (Kerlinger 1973). To this end, research and theories are interrelated. A theory provides a conceptual framework for research. Research, in turn contributes to the development of a theory. (Plant, 2012).

In the research conducted by Santosh Paudel (2015) on the perceptions of teachers and students on the use of ICT in teaching Mathematics linked his study with constructivism theory whereby he highlighted that constructivist learning works nicely with electronic learning activities. Learners come to this environment with different prior knowledge. The educational background learners already have, help to effectively involve in online activities like searching in internet, collecting information, organizing their views, or collaborating with colleagues via email thus adding to their cognitive infrastructure. To this end, this theory is also in accordance to use of Smart classrooms in teaching and learning process.

In Ghana, Kassim Alabani (2015) on his work entitled teachers' perceptions and level of technology use in classrooms, he linked his research with behaviorism theory, whereby technology has been perceived as an encouragement that motivate students to accomplish their works and make learning more exciting to learners. He added that, the acquisition of realities through repeated practice or learning from the technology, is the goal of education. Additionally, computer supported instruction incorporated learning systems and computer-based education systems and assessment software are some of the technologies designed on the behaviorist learning theory. To this end, this theory is in line with the usage of smart classrooms in education.

In Kenya, Wanjala (2013)**,** conducted research on teachers' perceptions towards the use of technology in the administration of public high schools and linked his research with Diffusion and innovation theory. Also, in Belgium, Makalita (2015), matched diffusion and innovation theory with his research entitled Secondary school teachers' perceptions of ICT usage in Tongan Schools. To sum up, any philosophy must be supported by a theory for its educational implementation. In the same context, the use Smart classrooms in secondary schools supported by several theories and hereunder is a brief discussion about these theories.

1.6.1: Constructivism theory

The word "construct" in the education domain means to create a concept that is based on several pieces of evidence which are not always true. This argument stands that people dynamically construct new knowledge as they interrelate with their environment.

Constructivism put onward by Jean Piaget argument "*a child who enthusiastically experiments in activities develops enough active connection and is capable to organize and integrate his/her practices into daily lives*" (Mills et al., 2006). One of the most important principals of this theory is that students build their own knowledge from new concepts, as they cooperate with reality or others with distinct viewpoints. Constructivist learning environment involve learners to practice their prior acquaintance and skills to create new concepts in learning. From the above context the task of the educator is of facilitating and giving assistance so that students make actively their own comprehension. Educator with constructivism spirt must keep in mind that the knowledge that students already have is relevant and must be associated to the concepts being taught.

Most of educators using a constructivist viewpoint might focus on active learning environment that can integrate learners centered and problem-based learning in which students are actively involved in critical thinking activities. Therefore, use of smart classroom in classroom is based on the concept of constructivism where teachers stand as instructor and students actively take part in classroom. In constructivist schoolroom students solve the problem by working in group, meanwhile students are interested to do their work themselves and find out the solution of the problem. By using Smart classroom in learning student construct their ideas by visualizing and sharing their view. Thus, teacher play a role of facilitating, (Schultz, R. A. (2015).

The fact that, technology is becoming increasingly part of daily life, teachers must be the first to incorporate technology in education. The utilization of Smart classroom while teaching is one of the strategies that educators must adopt to support inter-connected learning. This statement simply means that, the presence of technology devices in education gives learners opportunity, capacity, and flexibility to be adaptable in multiple scenarios and with different subject areas. (James, 2015)

All in all, when smart classroom gets used in a constructivist way, pupils get opportunity to manipulate data, explore relationships, purposefully and actively process information, construct personally and socially shared meaning and lastly reflect on the learning process (Juniu, 2006).

From this view, Smart Classroom when used appropriately, it gives learners a lee way to express their thoughtful and allow them to arrange ideas into a more concrete form, in addition, it enhance collaborative learning. The use of Smart Classrooms in the teaching and learning process makes it possible for students to learn "on their own pace", the teacher gives general guidance on a concept and then supervises the students as they work together to build on prior knowledge to resolve a problem. In a nutshell, smart classroom helps students to have admittance to digital materials and

get closer with learning opportunities at any time and place, and through collaboration and explorations via the internet, students' abilities and attitudes get empowered and result to the knowledge construction.

1.6.2 Behaviorism theory

The big idea of this theory emphasis on change in behavior caused by the acquisition, reinforcement, and application of association between stimuli from the existing environment and responses from individual that help learning. Behaviorists believe that new knowledge can be acquired by operant conditioning where responses were learned from repeated stimuli and reinforced by rewards. Therefore, learning is undertaken as the step by step or succeeding approximation of the intended partial behaviors using reward and punishment. Skinner's theory is generally known as "programmed instruction: whereby the right arrangement of the partial behaviors to be learned is explained by elaborated task analysis. Pritchard, A. (2017). To that end a computer that is ceaselessly used by learner put into practice this theory. During the teaching and learning process using laptop assisted instruction, it gives supplementary information to the learner if an incorrect answer is supplied. This continues until the learner is successful.

According to Theodor (2021) Stimulus response theory was developed by Eduard Thorndike who supposes that learning stands with two things: stimulus and response. He believed that all learning depended on the strengths of the relationship between the stimulus and responses, if the relationship was high the responses was likely to take place when the stimulus was shown. When we talk about behaviorism, we may automatically think of Pavlov's dog. In his experiment, he discovered that the dog automatically salivated when meat powder in a dog's month. (Unconditional stimulus) he also revealed that the sound of bell concurrently with donation of meat powder, the bell become paired with the dog's salivation. Finally, the bell by itself provoked salivation to the dog. If the bell was presented repeatedly enough without associated with meet powder, the dog at the end, stopped salivating. This phenomenon was called extinction and it is commonly known as classical conditioning, (Ormrod 2016). The concepts of positive and negative reinforcement are affective techniques of learning and behavior modification as well as punishment and reward system, (John c Malone 2017). Thorndike also made wide pioneering research in learning and his work is taken as the first contemporary theory of learning. After his research, he revealed that the greatest characteristics of learning for both humans and animals are trial, and error also named connectionism or the stimulus response theory of learning. (John c Malone 2017).

From the above perspectives, the process of learning can be conceptualized as a sequence of small progressive stages lead up to a final performance. Bloom utilized this theory to create the Bloom's taxonomy that is used in evaluating acquired behavior to date (Eisner 2000). Dewey's classic works suggest a student-centered learning which led to the cognitive theory of learning. Moreover, in a study focused on differences in teachers 'uses of technology and their perceptions of the value or role of technology, Addison et all., (1999) revealed that most of the teachers in elementary schools in the United State of America took technology as an inducement that motivate students to perform their tasks and make lessons more exciting to students. In a nutshell both teachers and learners can increasingly use smart classroom in the learning and teaching activities since it provides supplementary resources and engage visuals to boost lessons and encourage students and teachers to look in advance the next lesson with hope to learn a new concept. In the other word the nature of technology is considered as stimulus, positive or negative attitudes of students considered as responses or reaction, behavior intention like acceptance or avoidance is just a behavior

1.6.3. Diffusion of innovation theory

1.6.3.1. Introduction to Innovation theory

According to Kaminski, J. (2011), who reviewed diffusion of innovation (DOI), innovation is an act of bringing or establishing something new in the organization. It can also be demarcated as an introduction of new strategies or establishment of a positive idea to generate new value. On the other side, diffusion is the collective process overtime.

Researchers revealed that people who early assume the innovation have different characteristics than those who lately adopt it. Therefore, it is important to consider the individual differences of the people that will support or undermine adoption of the innovative idea, when promoting it to a target population, (Bervell, et.al.; (2020).

Kaminski, J. (2011). adopted five crucial strategies necessary to be applied to adaptor categories:

- Innovators: They are the ones who need to be the first to attempt the innovation, they are very interested and willing to take risks of establishing new ideas.
- Early adopters: these are the ones who stand in the place of opinion leaders. They are mindful of the need to change and contentedly implementing new ideas. These population needs various strategies including manuals and information sheets to convince them.

- Early majority. These people are infrequently leaders, but they assume innovation before others. This means that they need to see enough evidence on how the innovation works before they engaged in applying new ideas. For more convincing them, strategies like telling a success story about the innovation and other evidence related to the effectiveness of innovation are highly needed.
- Late majority: those people are resistance to change in their nature. They only assume the innovation after having been used by the majority. They way of attracting these population include but not limited to share the information on how many other persons have exercised the new idea and implemented it successfully.
- Laggards: They are very conservative people due to their traditional believes. They are very doubtful of change and the toughest group to bring on board. Strategies to attract this people contain statistics, and pressure from other people of adopter groups.

Rogers (1962) described four components of the theory of innovation: The innovation, channel of communication used to spread information about the new change, social system, time taken by the adopter to move toward the implementation process.

According to James (2000), positive perception toward the new idea and its adoption can sometimes be enhanced by highlighting its resemblances to other ideas or tools with which the adopter is always comfortable. Weakness in considering issues of perceptions during the establishment and implementation of new idea or behavior leads to misunderstanding of the new concept.

Tunks, At. all (2009). Stated that before introducing innovation you must change minds and practices of the adopters. In his research he put into practice Concerns-Based Adoption Model (CBAM). The context of CBAM is that by resolving the worries of the educators during the process of adoption, the setbacks accounted during the implementation process decreased. In addition, he developed six statements in CBAM namely change is a continuous process not an event, it is realized by human being, it is extremely personal experiences among others. To this end, CBAM can be utilized to address and track the adopters' concerns and actions to innovation use.

Surendran, P. (2012) worked on Technology Acceptance Model theory. he declared that it is in fact a potential adopter's decisiveness and expectancies of the innovation that influence the level of its adoption. He added that there was a remarkable relationship between perceived usefulness and adoption. Therefore, the more students and teachers perceive smart classroom as an important

tool for effective learning the more they will appropriately use it. He ended his research concluding that, there is no matter how easy a technology is to learn; students and teachers would not assume it if they did not take it to be helpful in improving their efficiency. From this view, it is important to note that, innovation theory is linked with this research, hence smart classrooms are disposed to schools with purpose of helping students to become innovative through personalized and collaborative learning. Teachers and students must play a big part in the execution of this theory. The collection of data on students' and teachers 'perceptions is one of the ways to track gaps in the effective use of smart classroom.

1.6.3.2. Application of the theory in this research.

To put into practice the diffusion of innovation theory, teachers must have information on the use of smart class technology as a new idea to enhance education. They must be aware about the utilization of technology tools like computers, internet connectivity, projectors, and other relevant facilities before being introduced into the education system. Over and above that, technical support should equally be provided. Afterward, teachers should be convinced and be willing to actively take part in the implementation process by attending to various aspects of contexts within which the innovation is being used. Besides, capacity building about the process should be provided to teachers, positive attitudes towards the innovation must be generated among the adaptors. lastly, positive perceptions towards the use of the innovation must be raised up for better implementation of the new input.

In this study the factors that influence adoption and innovation theory as developed by Rogers in 1962 were applied in assessing the perceptions of teachers towards the implementation of Smart classroom in secondary schools:

- Relative advantage: it gives the idea about the level to which the new idea that are being introduced in the system is better than the one it replaces. In the context of this research, it helped to assess whether the awareness on the need of smart classroom was done to fully explain its advantages.

- Compatibility: it refers to the extent to which the innovation is in line with the experiences, values, and potential adopters 'needs. In the vein of this research, this factor helped to examine whether smart classroom is under teachers' priority and preferences to improve their teaching work.

-Complexity: it stands to assess how hard the innovation is to understand and practice. In the style of this research, it helped to judge whether the concerns of teachers and students have been considered during the introduction of technology-based classroom initiative.

-Triability: the extent to which the new idea is experimented before its adoption. In this research, it helped to investigate whether they have been initial use of smart classroom to test its effectiveness before being established in secondary schools.

-Observability: the extent to which the new initiative provides perceptible results. In connection with this research, the factor helped to assess if there are instruments planned to evaluate the successfulness of smart classroom in teaching to judge whether it can be adopted or rejected.

The application of diffusion of innovation theory to this research gave a context intervened in assessing why some teachers use smart classrooms in their daily activities while others do not.

In general, diffusion theory can be used to explain and predict challenges hindering the use of Smart classroom in all aspects of education. It can also help educators to identify activities that must be carried out in Smart classroom to make it more usable in teaching and learning process and appealing to potential users as well.

To sum up, constructivism and behaviorism theories are active when students are under learning by doing and this is the role of smart classroom in education. Constructivism focuses on bringing out prior knowledge of students, and the effective use of smart classrooms by students give teachers information about the prior knowledge of the students. Behaviorism believes in learning through reinforcement whereas constructivism focuses on experiential learning and these theories apply with the ICT tools (connected computers, projectors, smart board, among others) and they result in effective learning and teaching system. Connected computers are stimulus to students (behaviorism) whereas on the other side they help in constructing knowledge of students (constructivism).

Diffusion of innovation theory was found more relevant for this study because it brings out teachers and students' perceptions, types of activities to be performed and challenges regarding the use of smart classroom that teachers used to face. In the context of this theory, teachers and students need to be informed about the new idea before adopting it for use in their daily activities. The theory additionally clarifies that some teachers, students, and head teachers are slow in using productively Smart classrooms. In this context, diffusion of innovation theory is useful in the framework of this study, since it dictated in the formulation and administration of questionnaires,

analysis, and interpretation, and verify whether the establishment of Smart classrooms to the schools has done in accordance with stages of diffusion of innovation theory.

1.6.Conceptual framework.

Based on the concept of smart classroom as proposed by Zhu, (2012) "the core of smart classroom is to generate intelligent environment by using smart technologies so that smart pedagogies can be enhanced and provide personalized learning services and empower learners, and thus talents of wisdom who have better value orientation, higher thinking quality and stronger conduct capability could be fostered".

Smart classroom as was used in this work includes electronics such as computers connected to the internet and other devices that can be attached to computers namely Screen projector, smart board among other aspects. The purpose of smart classrooms in Rwanda, is to embed technology into numerous aspects of the country's education aspects and revolutionize learning and teaching process. The policy seeks to incorporate technology in all activities of education such as lesson preparation, lesson delivering, assessments and research among others. To this end, the issue of teachers and students' perceptions on the use of Smart classrooms is a matter that needs much more investigations since it is a new concept being implemented in Rwandan education system.

Kugamoorthy, (2019), observed that students positively perceived that smart classroom practices may produce meaningful advantages in changing the traditional way of teaching, offering updated subject information, increasing efficiency of the teaching, and learning process, rising the interest of students, develop students learning ability and all in all promote collaborative learning which is one of the most effective forms of learning.

In 2017, the Government of Rwanda unveiled the project called 'smart classroom' project in which all schools were to be installed with state-of-the-art technology classrooms, remove chalkboards, each student owns a laptop, and those laptops would be installed with software that blocks students accessing bad content like pornography, (Kimenyi, 2019). Additionally, Government supply materials such as computers, internet, building infrastructure that would help in developing teaching and learning by using ICT hence students should be prepared to 21st century.

This framework describes three independent variables such exposure students into smart classroom and use it appropriately, presence of smart classrooms in the secondary schools, and effort

expectancy of ease of use of Smart classrooms. The variables were examined to determine their impact on the behavioral intent to use smart classrooms in teaching and learning process. The influence of three extraneous variables namely teachers 'competences, age, and student's prior ICT background, was also be taken into consideration to create their effect on each of the independent variables.

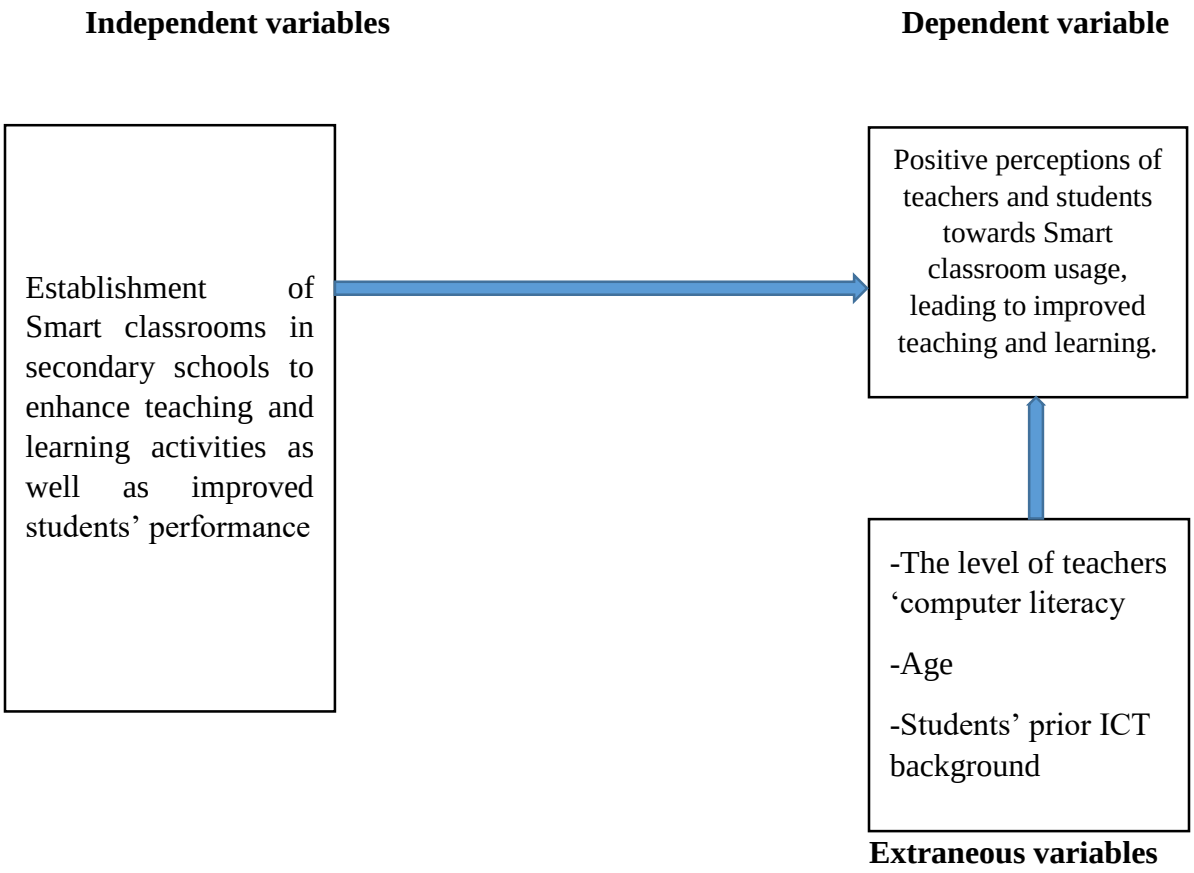


Diagram 1: dependent and independent variables

CHAPTER TWO: LITERATURE REVIEW

2.0. Introduction

The main purpose of the current study is to explore the teachers and students' perceptions towards the use of smart classroom in Rwandan secondary schools. This chapter accounts for relevant literatures on which the study is based. The function of literature review is to examine and critically evaluate scholarly articles, books and other sources like dissertations, conference proceedings, and news articles relevant to the research topic. The main purpose is to provide an overview of what knowledge and ideas have been, or been established in the areas of focus, their strengths and weakness, and to serve as benchmark for the direction of research scope. In addition, literature review allows up to date perspectives of the state of the state of research in the field and enables discussion of any contrasting viewpoints on the topic as well as to develop general explanation for observed variations in a behavior. More importantly, literature review can serve to give direction to build the case upon which the discussion of the research will rest.

This literature review will try to build up an analytical and comprehensive body of knowledge and information with regards to teachers and students' experiences on the use of smart classrooms in Rwandan context in general and the idea of technology enhanced learning , smart learning atmosphere, concept of technology enhanced classroom, teacher discernments on the use of technology in education, state of the implementation of education technology and the role school leaders on the use of smart classroom.

2.1 Definition of Key Concepts

Perceptions: according to Cambridge dictionary perception is defined as a belief or opinion, often held by many people, and based on how things seem.

Teaching is the process of engaging students in learning to empower the understanding of new concepts with intend of adding new information to the existing skills and knowledge. (IGI Global, 1988),

Learning is defined as the transforming process of acquiring information, internalized, and mixed with what we have experienced, changing what we do know and build on what we do. In the other words, learning is the process of taking in the new acquaintance, or changing existing experience, skills, behaviors, values, or settings**.** (the eLeaning coach, 2019)

Personalized learning: refers to the education under which the pace of studying and the encouragements are enhanced for the needs of each student. In other words, the objectives of leaning, teaching strategies, and content vary based on student needs. (Wikipedia, 2020)

Collaborative learning is an education tactic that includes groups of learners who work together to resolve the problem, complete an assignment, or create a product. (Laal, at.all,2012). Also, Collaborative learning stands on the idea that learning is a normally social act under which the students exchange among themselves (Gerlach, 1994). In addition, Collaborative learning builds on a pattern that knowledge may be created in the general population where members actively communicate by sharing skills and experiences and take on asymmetric roles. (Wikipedia, 2020)

Traditional instructional mode: Methods of teaching that include drilling, lecture, notes taking and exposition.

Educational technology: Is the use of both computer hardware, software and educational theoretical to ease learning and expand performance by using and managing properly technology process and resources (Wikipedia, the free encyclopedia, 2020)

Net generation: a group of young people who have grown up in period exposing them to computers-based technology, and their approaches of learning are differ from those of preceding generations. (Lippincott, J 2005)

Smart classroom: Is a technology enhanced learning classroom that supports the way of teaching and learning digitally. This classroom is equipped with laptops, an internet connection, projector, whiteboards, and other digital tools that make lecture easier, engaging and more interactive (Mugisha,2021).

2.2: Review related to teachers and students' perceptions towards Smart Classrooms.

2.2.0: Introduction

The world is now experiencing a rapid rate of change and has become more interconnected than in the earlier period. The change led to the ever-increasing levels of economic competitiveness and rapid social change. As part of these changes, Information and Communication Technology has had a massive impact on peoples' lives. (Boonmoh, 2021). To be aligned with the changes related to ICT, Rwanda Education Board has initiated a tool which will help in improving quality teaching through the digitalization of educational materials and facilitating enhanced teaching hence the courses which are interactives and multimedia based enables learners with self-learning and give

hand to teachers to prepare lessons. (REB, 2018) . In this context REB and its partners have distributed ICT devices such as computers, projectors, internet connectivity and digitalized content, to the secondary schools with the focus of creating Smart Classrooms in different schools across the country so that Smart learning can be promoted.

2.2.1. The concept of Smart classroom

The concepts of Smart classroom in relation to pedagogical setting with the arrangement for designing that classroom for transforming learning spaces in modern smart classes. In general, we have seven basic concepts for a smart classroom which are the following:

- **Adaptability or flexibility of S.C**: this is about the classroom design, where all the elements are in the exceedingly way that it allows gracefulness and variations in seating. In fact, students have different learnings favourites and teachers too have different styles of teaching. To this end, Smart classrooms should be set in a way that students should be provided with good environment to appreciate modern technology. Then, teaching mode must be dynamic to make sure that students are both engaged and focused.

-**Comfort of Smart classroom**: Nowadays learners are having access to technological devices such as computers, Smart phones, tablets, among others, even the use of social media platforms have been increased. Therefore, the teachers must fulfil the needs and interests of the learners for the optimum smoothness to create learning experience enjoyable by using video watching, music playing, debating, and reaching.

- **Connectivity**: For the interactive leaning, students must have technological devices connected to internet to promote social connectivity with their follow students, teachers, and professionals.

- **Multiplicity**: Nowadays the resource of knowledge is not only from the teachers, but learning can also happen everywhere not only in the classroom. Smart classrooms provide stimuli and resources for being creative, critical thinker and reasoning people to customize the various learning styles for making learners who are termed out of the box learners.

- **Openness**: for the effective of technology enhanced classroom utilization, the transmittal manner is disadvantaged, with the smart classrooms learning and teaching process happens out of limited classrooms spaces whereby visual and physical teaching learning process happens.

-**Personalization:** Ownership in teaching and learning process is a key gold in learning, so teachers and learners must take stings as their own likes and needs. (www.vedicventure.com/smart-class-content.html)

2.2.2. The concept of smart learning.

As an innovative education pattern, smart learning is described as a technology enhanced learning. It is built on smart devices and intelligent technologies (Zhu Yu 2016). As has been pointed out and strongly studied in last years, technology can be put into effect to help learners expand their learning ability. In other words, the adoption of technology in education can serve as media or tools for accessing instructional content, investigation, communication and interaction construction, expression, and assessment (Lee, 2020).

According to Wang (2014) the increase of mobile, internet connectivity and personal technologies, has brought about a significant change that moving learning style away from learning using mobile toward the ubiquitous learning whereby learning takes place anytime and anywhere without the constraint of time, places, and environments (Wang, 2014).

So far there is no common meaning of smart learning, researchers and educators are continuously reviewing the idea of smart learning. However, Hwang (2014) defined smart learning in the context of ubiquitous learning. Also, Pierce (2014) explained smart learning in three perspectives: first, smart learning put emphasis on content and learners more than on digital tools, secondly, it is operative, smart, personalized learning based on advanced technology tools able to engage students in the learning process. To this end, smart classrooms play a significant role in supporting smart education, but the focus should not just on the utilization of smart devices.

Lee, (2020) also worked on the learner-centered leaning of smart learning and how it is gained using smart classrooms. He revealed that students know how to think, analyze arguments, solve problems through the engagement of students and promoting collaboration among students and expert teachers. The personal and smart technology make learners active in their learning and expand their independence in wider open, connected, and improved ways by personally richer contexts.

Sung, M. (2015) presented the structures of smart learning that is described as self-directed, encouraged, adaptable, resource enriched, and technology embedded. Gros, B. (2016) suggested that the aspects of smart learning comprise formal and informal learning, social and cooperative learning, personalized and situated learning, application, and content focus.

2.2.3. Smart Learning environment

The learning environments in school is explained as “a classrooms or college climate, situation, mood, tone or vibes”. The classrooms environment differs from a place to keep books, desks, and

other school materials it is just a place whereby all activities associated with the teaching take place. All elements in classroom contribute to student's learning experience, support and reinforcing students desire to learn. (Li et al., 2015)

Lizzio, (2002), stated that positive school environment impact pupils toward deep tactics to learning. Additionally, perceptions of teaching environment effect learning outcomes both directly (perception of outcomes) and indirectly (perception of approach to outcomes). Rahman (2012) revealed two learning environment elements namely learning community and evaluation and they had a straight connection with three other elements such as "clear goal, appropriate teaching and learning resources, and were directly related to basic skills by learning approach. This research reinforced the social cognitive theory's hypothesis that students 'generic skills result from the interaction with their environment.

Normally the new skills learning is not only supported by learning content and learning approaches, but also the learning environment. Emerging learning environment is identified with the new tools like, Learning Management System, (LMS), Virtual Learning Environment (VLE) and Knowledge Management System (KMS). (Wilen 2009)

The student is always taken as the core element of smart learning environment, and the main purpose of smart learning environment is to provide self- directed learning, self-commitment, and personalized services which learners can attend courses at their own rhythm and are capable to evaluate the tailor teaching and learning activities around each student's interest, need and capacity basing on individual differences (Zhang at.all,2020).

Koper, R. (2014). anticipated that smart learning environments are natural environments enriched with ICT facilities, context-aware and adaptive to promote faster learning and ensure better leaning outcomes. Hwang, G. J. (2014) indicated that the crucial criteria of a smart learning environment include context-aware, capable to provide immediate and adaptable support to learners, and able to familiarize the student interface and subject contents.

According to Hwang, Smart learning environment do not only help students, teachers, and education leaders to have access to ubiquitous facilities and interact with the educational system anywhere and anytime, but also offers the essential learning assistance, suggestions, or helpful tools to them in the appropriate manner, right moment, and place. (Hwang, at. all 2014). To this end, Learning can happen at anytime and anywhere via the utilization of smart devices.

Scott, (2010), considered smart learning environment, approach that help learners to bring their own knowledge, experiences, and ideas to play a significant role in taking broadly new knowledge

and competences. Also, smart learning seems to be a service-based on semantic networks and pervasive computing. The learning environment is made of ubiquitous learning spaces, which convert traditional learning spaces into intelligent ambient learning environments through context awareness and real-time learning services. Hwang, (2014). defined a smart learning environment as high-level digital technology that promotes learning context awareness, identifies learner's characteristic, offers adaptive learning resources and convenient collaborative tools, records learning process automatically and assesses learning outcomes. Its objective is to establish easy, engaged, and appropriate learning for learners.

Based on networked facilities and services, smart learning environment is learner initiated and cooperative, hence it helps planning and innovative alternatives for students and teachers, and should be efficacy, proficiency, commitment, versatility, and thoughtfulness. And these characteristics could include support for interaction, learners in need of additional support and their motivation.

2.2.4. Smart classroom as strategy of enhancing ICT in education

The smart classroom concept has come into the works as internet-based distance instruction method, or as environment embedded with technology. At first, the term Smart classroom is for distinguish from the term computer classroom. It often refers to the classroom equipped with interactives tools such as whiteboards to support interaction between teachers and students and carry out teaching and learning activities (Li Et al. 2015).

According to Phoong, (2019) smart classroom is basically technologically and electronically improved classroom which is the instrument used for teaching to the learners by the method of electronic learning. The concept of technology enhanced classrooms does not completely do away with the old method of teaching. Rather it looks to club the importance of technology with conventional methods. For instance, the instructor while delivering a lesson on lacs will complete the information given in books by showing a move of how the lacs are useful in fishing. Electronic learning refers to the use of internet technologies to provide a broad array of explanations that enrich comprehension of the concept and performance. It based on three essential criteria:

1. Electronic learning is networked. Its interconnectivity makes it capable to update subject matter, store information and sharing.
2. It is delivered to the end-user through a computer that is connected to the standard internet technology

3. It also emphases on the broadest view of learning; it means learning solutions that exceed the traditional concepts of training.

The report made by UNESCO in collaboration with Pacific Regional Bureau for Education, stated that the incorporation of technology in all aspects of education is in four Priorities:

1. Equip Secondary education, technical vocational education, and training (TVET) and higher education with digital devices
2. Improve quality of learning and lesson delivering.
3. Promote equity, equality, and inclusion.
4. Make easier monitoring and evaluation.

According to UNESCO (2014), Hong Kong was on top in terms of primary student's computer ratio whereby one computer for nine students, whereas one computer for 14 students in China. Besides, Nepal is the highest ratio of one computer per 500 students. As conclusion, the integration of technology in education has found traction over the world, with different ration. Pointedly Socioeconomic discrepancies among nations manifested in the form of digital divide as well as the inequality in terms of accessibility to technology facilities and tools together with digital capability development. Furthermore, main cities tend to gain more compared to rural smaller cities and rural areas. At the global scare, technology in education will continue to grow and probably in the volatile way which requires progressive learning and capacity building on the teachers' side. (https://rwanda.vvob.org/publications)

In Europe, the incorporation of technology in all aspects of schooling is more sophisticated. Due to the result for a survey from schools that utilized technology in education, published in 2019 with the support of the European Commission, stated that 1 student out of 5 European attends schools with high-speed internet. In Europe North countries like Finland, Denmark, Iceland, Sweden, and Norway take lead to the disparities. schools from major cities were found at the forefront. (https://rwanda.vvob.org/publications)

Ambitious technology-based projects have been started worldwide, United Kingdom Open University that established in 1969 as the university of the air. This is the example of such project. All its programs were offered through radio and television in partnership with the British Broadcasting Corporation (BBC) and mailing. This achievement inspired the world to open universities around the world and campus-based universities of such type. (https://rwanda.vvob.org/publications)

In America, the inequalities in the sense of incorporation of technological devices in the corner of education implicate the economic disproportions, North America takes lead. In USA basic education may be provided through e-learning and there are quality standards that direct these practices. At the tertiary education level, universities adequate learners to have a certain number of credits from virtual courses. In Canada, technology is incorporated in the system of education to help all students in acquiring relevant abilities to use technology and internet connectivity, comprehend, contextualize, and deeply assess digital media for making knowledgeable decisions and producing content as well as communicating appropriately in the use of technology. In both Canada, and USA the access to technology and ICT Competences prevails and it is in the case for the other countries. (https://rwanda.vvob.org/publications)

In Africa, technology embedment in the system of education differs from country to another and educational level. Research made by Trucano, 2005) on comparative Study on electronic preparedness in Schools revealed that African countries tended to prioritize ICT in secondary education courses than in primary level.

Rwanda has put emphasis on the sector of education, various initiatives like provision of free and compulsory education for 12 years basic education and expending free education to twelve years education were undertaken. However, the report published by UNESCO in 2015, ranked Rwanda as the second country with lowest computers-learner ratio whereby 40 pupils utilized one computer in secondary and primary education. It is afterward Mauritius with 23 pupils per computer at primary schools and 19 learners at the secondary level. On the other hand, the ratio was higher in Madagascar whereby a computer used by 500 students (UNESCO, 2015)

After the above description, a pilot project renowned as an ICT transforming Education system in Africa has been established by UNESCO under the sponsorship of the Government of Korean. This pilot project started in Rwanda, Mozambique, and Zimbabwe with intent of sharing learnt lessons among other nations of Africa and another continent. Specific to Rwanda, the focus of project involved contextualization and institutionalization of teachers on the educational use of technology and utilizing electronic evaluation to reinforce teaching activities.

To effectively implement technology in education, Government of Rwanda established Rwanda basis education Board in which the ICT in Education Department is located. The main responsibilities of this department are to implement and supervise all activities related to technology in schools.

Integration of technology in teaching is one of the cornerstones help in improving education across the digitalization of didactic tools and enabling better-quality learning. Across the country, REB's ICT department is distributing digital tools in schools help to suitably equip smart classrooms. Think of Smart classrooms in school can bridge stone instances for education by incorporating learning technologies such as computers, specialized software, internet, audio responsive technology, projectors, and interactive whiteboard.

Technology enhanced classroom in schools is reflected as significant point in expanding the good quality of education. It is also utilized to measure learning outcomes. MINEDUC trusts that the establishment of Smart classrooms across all levels of education, will contribute to the achievement of its mission which is to change people of Rwanda into skilled human capital able to contribute to the development of the country. (ESSP, 2018).

The main goal for setting up smart classrooms, is to strengthen adaptive learning for student achievement. The Government of Rwanda' approach stood to decrease gradually infrastructure investment and the printed textbooks to put effort on curricula and cloud-based services and capitalize in classroom enhanced technology for adaptability and personalized teaching and learning activities. To this end, Rwanda Basic Education Board established Electronic Learning platform to facilitate the management of content, content delivery, online and offline approach. Promoting education by introducing technology in education is a paramount step concerning the foundation of a knowledge-based economy through promoting 21st century learning services that allow primary and secondary learners' timely development of computer skills and increasing their knowledge by making internet-based research.

2.2.5 Smart classroom an effective technology for teaching.

Nowadays, educators are teaching by using smart classroom besides the conventional black board and a result, they do not use chalk and talk approach in a regular classroom. According to Jena, A. K. (2013). This concept is undoubtedly good, but in the other way, it may possibly decrease the students' ability of brilliance to solve problem and to recreate new ideas.

Generally, the quality of teaching depends on the teachers' wisdom and their depth of knowledge, but how much they integrate this knowledge with the students' prior knowledge is remarkable. On the other hand, the students should be equally eager to learn from the teacher. An effective teaching

process and learning environment of the classroom mostly depends on teacher's responsibility, enthusiasm of teaching and students' interest of learning. (Lauermann, 2014).

According to Mushimiyimana (2021), the concept of Smart classroom has been introduced in Rwandan education system under the government's plan of preparing students to 21st century. Different approaches of distributing materials like computers, internet and building infrastructures put in place to more develop teaching and learning process. To him, Smart classroom technology offers positive education results and quality of teaching enhanced because of new ideas students construct while making research. In the same context, Van (2009) revealed that smart classroom focuses on technologies enhanced teaching and learning process and it provides positive teaching outcomes and the quality of teaching and learning improved because of innovations.

According to Ngendabanga. et al., (2021) the use of smart classroom in teaching sciences like chemistry increase the performance of students. When students shown the chemical reactions, they gain skills for creativity and innovation to create something new in the society by mixture of knowledge, skills, and attitudes. The introduction of innovative technology has altered the curriculum into educators 'daily activities which is motivation task. Correspondingly, Smart classroom enhanced achievement and positive relative between inspiration of the students and academic achievement. Technology in education boosts engagement and motivation of students by cooperation and communication with ease. Pupils acquire easily abstract and tough theories through animations and visuals which makes learning pleasurable for learners. Furthermore, smart classroom enables teachers to assess and judge the learning achievement in class by using innovative assessment technology. Ngendabanga et al., (2021).

In Rwandan education system, smart classroom was introduced with intend of quick digital assessment to measure the level of comprehension, less use of chalkboard, offer students free access to audio-visual, presentations and digital content which brings the idea to life engaging learners for becoming agreeable. In this concern, Smart classroom is an effective strategy raising students' performance in all subjects taught in secondary schools. the use of smart classroom expands learners' understanding and knowledge in comparison with to no use of the smart classroom. students who are learning through smart classroom work better than those who are not subjected to it. Ngendabanga et al., (2021). Teaching and learning by using smart classroom play a big role in education henceforth smart classroom is far superior, greater, and easier to access warehouse of learning and teaching materials whereby internet enable to storing saved teaching and learning facilities, which is easier to do on computer than keeping handwritten notes.

Ghani (2009) revealed that the utilization of smart classroom in teaching helped students to progress in the lessons for their own pace, and it expands students' achievement, which is the main objective of education. Also, smart classrooms engage students and teachers with web approaches aiming at supporting a community of learners in rising knowledge.

In a study conducted on the smart classroom: merging technologies for seamless tele-education, revealed that most of the cases, live instruction catches students' attention and interest much more effectively than static materials of traditional classes. (Shi et al., 2003).

In addition, the smart classroom activity increases the depth of students' conceptual understanding by breaking down learning goals into manageable sections and at the same time collaborative learning can be implemented. To this end, smart classroom is a key strategy to increase the capability of students since it makes the learning and teaching more attractive and collaborative which leads to the improvement of students' performance.

According to Marcellus (2002), the mixture of chalkboard and smart classroom should be more useful in learning. Therefore, the instructors must constantly keep in mind that learners have different needs and styles of leaning. Likewise, it must always be reminisced that the teacher's objective would be learning and that the outstanding teaching skills are required to reap benefits from technology and overwhelmed its shortcomings.

To him chalkboard is more suitable for presentation of solved examples and working through problems because it helps students to keep pace with the teacher and they need to see through processes under working out. Also, blackboard Teaching allows for more collaboration between teachers and learners, and the ability to solve with the guidance of the professor more dynamically. However, Smart class is good to present a large volume of information.

2.2.6. Perceptions of teachers toward Smart classrooms

According to Burke's reports (2015) in the work entitled "Teachers 'Perceived self-Efficacy in integration technology into pedagogical practice and barriers to technology integration. The primary findings in this study are reported to provide indications that "not all teachers felt prepared and confident to integrate technology in the classrooms. Qualitative data indicate that teachers were willing to integrate technology but felt ill prepared or unsupported to change their practice.

On the work of Pita (2010) about the investigation of teachers on the use of technology, he found out various issues teachers perceived as crucial in technology's integration, such as, need for continuous ICT professional development, need for ICT support to develop skills and knowledge of ICT, need for support to schools in building ICT resources and infrastructure together with the need to develop policies in education to guide ICT in education. However, studies by Cox et al., (1999) revealed the mismatch between what teachers valued as important and what they practiced. Teachers may value ICT, but that does not necessarily mean that they will practice it. Also, a fully developed ICT infrastructure does not reflect better teacher ICT competence (Mwalongo, 2000). To this end, the teachers' adoption of ICT depends on teachers' predispositions and understanding of their roles in ICT like ICT support training, technical and teaching support, ICT literacy network and various other circumstances and influences.

M. Anita (2013) studied the perceptions of educators towards the application of computers in teaching learning process and the usage of smart classroom. The results show that teacher educators have good computer operational skills but the facility to apply and integrate computer education in teacher educational institutions is very nominal. Only teacher educators are utilizing internet in their day-to-day academic updates. Many of the variables chosen for the study have no significant influence on the perceptions relating to the application of computer in teacher education.

Yadav (2012) studied about awareness and use of information and communication technology (ICT) by secondary school teachers. The awareness toward ICT was found to be high but use of these tools or practical knowledge found to be low. They are aware and use traditional tool, but they are still lacking in use of computers and internet. Awareness and use were seen to be influenced by amount exposure obtained in government aided and private schools. Study emphasizes that many teachers are still not serious about the use of ICTs in classes.

United States teachers talked about the way technology can improve learning for the pupils and how it makes their works most excellent. Also, they explained that technology can increase students' success and productivity. They said that they want schools and teaching space to be equipped more, starting with computers with internet, projectors, and Smart boards. When that occurs, the teachers use 20% information from the books and expand mutual learning to 80%, so they will engage and learn more about the subjects. Furthermore, the types of collaborative course and applications online is so far more inspiring and attractive to students than old school paper and pencil activities. (Alharb, 2013)

Teachers from Saudi Arabia pointed out the real issues with today's generation. They explained that the current generation of students was born and grown up with all technology available and closer to them all the time, therefore the government and teachers would encourage them to exploit it at the maximum level, even outside the class, for class works instead of doing other stuff. They also believe in the importance of technology but not for everything. They added that teachers are an important foundation in learning and teaching so that they should use the same language the students use, which is technology, and they believe, without the use of technology in the schools, there is a gap and lack, especially with this generation.

According to Santosh Paudel, teachers accepted that the usage of technology enables to produce many examples and support their work. Thy also argued that the use of technological devices and resources could support learning and teaching activities (Paudel, 2015). Santosh Paudel revealed that teachers must change themselves and accepted the demand of time. Teachers that he interviewed said that they have been taught traditionally and that might have been enough during that time. They added that nowadays the time is different and the teachers who are not capable of using technology in education cannot complete in the field of education. They stressed that the importance of using technology in education is significant because technology contribute significantly to supporting teaching and learning activities.

According to Alharb (2013), Teachers' perceptions and their attitudes towards students, are key factors in teaching students how better use of technology to carry out educational goals. Teachers with traditional philosophy about teaching always have a tendance to utilize moralistic teaching methods while teachers with constructive philosophies tend to use students centered inquiry-based methods (Alharb, 2013). In addition, Teacher's belief is another key factor that influence technology use in schools. To this end, the proficiency of teachers' technology incorporation may be influenced by their interest and attitudes vis-à-vis technologies. In the United States, teachers were provided with the most updated technological equipment. Additionally, they received also extensive technical support and development to help them with executing these technologies. However, teachers' pedagogical perspective remained limited for using technology in classrooms. (Dwyer, 1996)

In Tanzania, Alcuin Mwalongo made investigation on the perceptions of teachers on the use of technology tools for teaching, administration, professional development, and personal use. The findings indicated that the use of technology tools and resources in education help teachers to resolve immediate difficulties related to learning and teaching they confronted throughout the

course of teaching. students use technology in teaching for different reasons namely look for educational materials, lesson planning, preparation of notes as well as teaching it as a subject. However, some teachers did not use ICT to improve their pedagogical practices, but rather to sustain their traditional practices. (Mwalongo, 2011)

In Nigeria the study conducted by Fatimayin (2007) on how the secondary teachers perceive the use of information and communication technology in teaching English, revealed that teachers have a positive idea for what ICT is and how technologies devices can be used to teach. In addition, most of teachers agreed in varying degrees that computers, emails, the internet, mobile phones and iPad are gadgets that can be used to teach English language. However, only a handful of these teachers are computer literate. Another important point they raised is that the technology can benefit teaching/learning of English language in that it can help improve instruction delivery and make teaching more effective. (Fatimayin, 2007).

2.2. 7. Students' perceptions on the use of technology in education

According to D. Galanouli et.al., (2016) for the research on students' perceptions of Information Communication Technology - related support in teaching placements. He found that there are insufficient skills on the part of the teachers and students in schools. he added that, when students are competent users on their own, they take initiatives to use computers without waiting teachers' support. The other Students reported that most of the time computers are used when there is a general inspection across the school. Uwantege conducted a study on the attitudes of students and smart learning in Rwandan secondary schools. the students stated that smart classroom makes learning more exciting. They added that when they have homework they prefer to refer to google before going to school. In the same concept they go to the internet for better understanding a difficult concepts. to this end, the completion of assignment using internet, improve their skills on ICT, (Uwantege ,2021). Students appreciate how smart classroom is important for learning, even though they do not make extensive use of it. (Urunana rw' abarezi, 2019)

D. Galanouli et al., (2016) found three main barriers students face during school practice: teachers' feelings, lack of adequate devices and time. Byrne Hill (1997, revealed that older teachers sense worried when facing the advancements of technology occurred long later, they were skilled. Besides, there is a lot of technophobes: younger staff are the ones who tried to use networked computers, the older ones keep well away from them.

In addition, Virginia et.al., (2016) made research on Students' perception on use of technology in the classroom at higher education institutions, specifically on the unintended consequences of use of technology. Research showed that, technology devices such as computers, and projector used in teaching and learning activities have both supportive and unsupportive effect on academic environment affecting both students and teachers. The negative consequence of use technology in the classroom are that students accessed social websites such as face book, Twitter, YouTube, WhatsApp while in classroom followed by playing the games. These results indicate that most students have used technology in the classroom in a way which could be disruptive to the classroom learning. however, the research showed that most of students are likely to use technology in classroom for the intent of positive effects than negative consequences since it may help in enhancing learning related activities. (Urunana rw' abarezi, 2019).

2.3 Teaching and learning activities teachers perform in the smart classrooms.

Classroom is the place where students learn and gain knowledge. The concept of books, copies, and notes was followed to maintain the teaching learning process. With the advancement of technology, this typical concept is getting replaced by new concept known as Smart Classroom where teaching leaning process happens in a more interactive way and students get more interested because this process consists of video, pictures, and PowerPoint presentations. Digitalized classrooms are a modern-day pedagogy method that brings the concept of implementation ICT in education. This innovative and meaningful use of technology is transforming the way teachers teach and students lean in schools. Smart classrooms tools are a success because visually attractive methods of teaching engage the audio-visual senses and are proven to be more appealing to the students. (Samapika,2020)

The use of desktop or laptop makes students feel more comfortable and confident. In a digital classroom a desktop or laptop acts as the central system that stores information and essential lessons with the help of projector the pre-loaded lessons can be maximized into a big screen and can be taught with ease. (https://en.wikipedia.org, 2016).

The use of new technology has changed the educational or learning environment for students, here educators can fulfil the needs and interest of students. Smart classes include activities like reading, writing, debating, watching videos, and playing music. It shouldn’t solely encompass learning however offer space for optimum comfort to create learning experience enjoyable.

Besides this, Smart classrooms play a role of connectivity, which is in two parties: an internet connection to devices and informational/Social connectivity where students can connect to their friends, teachers, and professionals. The rate at which mobile devices and Internet of Things are making an entry into the market in today's world is terrific and Smart Classrooms are the only early adopters to this technology, (Lall et. al., 2020).

According to Lall et al., (2020) Smart classrooms have capabilities for utilization for several stimuli and resources. In this view, there is a space for creativity along with critical thinking and reasoning and it can be customized for various learning style and needs of learners which is termed as out of the box.

Also, in the traditional system of learning, a teacher only presents some information and conducts lessons in transmittal manner. To this end, in Smart Classrooms, learning occurs beyond limited classroom spaces, means both visually and physically learning occurs but in traditional system only physically teaching and learning takes places.

In Smart classrooms, teachers and students can personalize their settings as their own likes and needs. Students and teachers can introduce new activities for useful learning through plan lesson, select content, teach, and select, assess, and evaluate. (C., Matulich, E., Papp, R., & Stepro, J, 2006).

In general, the focus of Smart classroom is visual learning (animated multimedia lessons), quick and immersive learning, progressive improvement in student education, to look for overall high performance, student assessment and evaluation, and report cards.

According to Rwanda Education Board Smart classrooms is composed of the following:

Table 1: Component of smart classroom

Tools	**Function**
Computers (Laptops, desktops, tablets, etc.)	Typing, preparing teaching, and learning materials, displaying learning content, setting assessment, etc. When connected to internet, it can help in making research, accessing different teaching, and learning materials, sharing resources and experiences,
Projectors	Projecting content/ information during class presentations. Content can be text, pictures/ images, or videos.

Televisions	Watching/ listening to information related to a certain topic
Mobile phones	Listening to audio materials, practice literacy skills through SMS/ WhatsApp, sharing information through social media. etc.
External memory disks (flash disks, external hard disk/ CD/ DVD, etc.	Sharing and keeping information about a lesson, a topic in a lesson. They can also be used for learners to practice saving and retrieving documents from an external device and for back up storage.
Radio	Listening to a lesson recorded or a broadcasting programme. It can be used for developing listening skills and languages skills. It can also be used for audio learning materials such as songs, poems, and others.
Printers	Sharing hard copies of lessons for students when they have no access to computers for revision, printing exams/ test, students can print some of their project works, etc.

2.4. Challenges in using smart classroom and strategies adopted

2.4.1. Lack of electricity and Internet connectivity

According to Kimenyi and Peter (2015) in some schools there is a shortage of electricity particularly those in remote regions, and this is taken as a challenge for delaying use of smart classroom in all Rwandan schools since adoption of ICT integration in education. In 2016, 66% in primary schools and 50% in secondary schools had access to technological devices that need electricity provided through the on grid or using off-grid solutions, like solar panel. Even if we have this percentage there is a big part of schools which are not connected to electricity, and this leads to non-use of electrical devices and this has a negative effect on use of smart classroom at both primary level and secondary level.

On another side all concerned stakeholders like ministry of education, ministry of infrastructure local government is trying to supply electricity where schools are built. In addition, even if electricity will be available in all schools the challenge of internet connectivity will rises due to its cost of reaching all areas. In 2016, primary schools' internet was at a percentage of 10% compared to 18% in secondary schools. However, MINEDUC put effort in dealing with partners on how it can install internet on affordable cost in both primary and secondary schools. As a solution the

ministry of education is looking how it can adopt and establish a network linking all learning institutions with aim of sharing educational software resources.

2.4.2. ICT resources not fully utilized

According to Peter and Kimenyi (2015) in some school's different technological devices are available but it is difficult to utilize them in daily activities of teaching due to many reasons such as lack of adequate training, some teachers are conservatism they don't want change, a big number of students per class in most of Rwandan schools both primary and secondary, insufficient time for both students and teachers that delay the use of smart classroom. In addition of that some teachers have been trained but they don't have time to provide training to their colleagues due to many hours in timetables, as a solution Rwanda education board is working on it with purpose of reducing number of hours per teacher to get time for training. the Ministry of education with aim of improving frequency usage of ICT in teaching adopted some strategies like provision of additional supplementary training materials and simplified manuals for teachers' reference, making frequent inspection on devices used in order to make sure that devices are in good condition, encouraging and motivating teachers to use smart classrooms in the schools, tests for teachers on use of ICT in order to provide training to them knowing exactly their levels, once ICT is integrated in education it will enhance performance for both students and teachers in using smart classroom. As mentioned in the paragraph above due to the ratio of students presented in primary schools where it represents 58:1 this delay usage of smart classroom in schools.

Sharma, B. (2010) studied the effect of ICT on academic achievement and professional interest of 401 B.Ed. students, The study revealed barriers teachers faced in the use of ICT such as t, lack of confidence, lack of competence, and lack of access to resources.

Sugiyama (2005), in a study on the use of ICT in teaching Mathematics and Science in Tanzania, identified three main conditions perceived by teachers as significant constraints that hinder teachers' practice of using ICT for making supplemental teaching/learning materials in the schools:

-Poor printing conditions in the school (support infrastructure).

-Administrative procedures for using ICT and for printing materials and problems pertaining to teachers themselves, such as lack of skills, motivation, and creativity. As for the administrative issues, they emphasized the necessity of administrative control over the printing procedure. They also showed great concern about security for computers in schools.

2.4.3. Theft of ICT equipment.

The theft of ICT equipment is a big challenge with direct effects on the use of technological devices that are available in smart classroom, school administrator does not make available some ICT equipment due to being afraid of being stolen and become untrusted by their managers consequently, this leads to administrator to make restricted conditions that do not encourage teachers and students to use smart classroom. As strategy for this challenges Rwanda education board has adopted device management, awareness building, storage, and follow-up issues in training session (Mugiraneza 2021).

Different strategies of preventing the theft of ICT devices put in place among others we can list: -- Physical lock of ICT equipment: that means to lock up the doors and windows of ICT equipment room or designate a particular room to store computers when unused and block the room.

-Electronic lock of computers: in addition to physical action to prevent theft of computers, electronic measures such as creating electronic ring barriers around schools so that if a device goes out of the school, will no longer work, in addition to that, computers can be remotely disabled. The aforesaid measures do not 'really protect the physical stealing of computers, but they make the stolen devices unvaluable.

- Keep a correct and updated inventory: having un updated inventory can contribute to easily identify when things might have gone away. Keeping track of serial numbers, can signal to thieves within the schools that you pay attention.

-Look over it closely: this is in line with deploying guards outside computer tools and instructing them to pay special attention to rooms where computer facilities are kept. Additionally, installing security cameras can provide some level of deterrence.

-Educate the users: train key possessors, teachers, IT staffs and school administrators about theft prevention measures, good behavior and practice and supporting message with posters can help a lot. (https://blogs.worldbank.org/)

2.4.4. Large number of students in a class.

According to Gambari (2007), inadequate and the poor working state of computers in Nigerian schools are the problems that teachers and students face to effectively use ICT facilities in teaching and learning process. Furthermore, Jegede, D (2019) discovered that, one of the major five

problems confronting execution of technology in education, is insufficient supply of computers in secondary schools comparatively to the number of students. Generally, there are limited operational ICT facilities in most Nigeria public secondary schools in rural zones.

In zimbabwe, Mwapwele (2019) revealed that there are inadequate computers in schools relatively to the large number of students and he recommended that the government needs to rise the grant for computer in all schools throughout the country, he added that, more ICT resources should be provided to schools to enable teachers and students learn appropriately

According to MUSHIMIYIMANA (2021), the issue of overcrowded classroom is one of the setbacks hindering the efficient use of Smart classroom in Rwandan secondary schools. One classroom in some schools can have more than seventy students, while smart classroom process 50 laptops. These issues get reported as the challenge for effective use of smart classroom. To this end, slow and less skilled students on computers fall further behind.

2.4.5. Language barrier and inadequate ICT literacy

Most of devices and electronic tools found in Smart classroom are set in English, therefore teachers and students who are not proficient in English language master difficultly the use of computers and its devices. From 2009 education system in Rwanda moved from French to English as language of teaching. As of that period to now, some teachers and school leaders faced with barrier. According to MUSHIMIYIMANA (2021), most teachers are striving to learn English, but it is still problematic hence they don't have sufficient vocabularies. the issue of not being able to express them while teaching lead to ineffective use of Smart classroom.

Another issue raised by Jegede, D. (2019) in his study on the obstacles preventing the effective utilization of ICT facilities in public primary school in Nigeria, is lack of experience and proficiency on the side of schoolteachers who are computer illiterate, in opposition to today's students who are quick to self-educate and extremely computer literate

2.4.6. Heavy workloads

Time plays a crucial role in making ICT materials by educators. In most of schools, timetable for teachers is heavy and there isn't a free time. In this concern, it becomes very difficult to incorporate technology in daily teaching activities. Majority of teachers claim they have no sufficient time for searching courses to be delivered in smart classroom. (Uwantege, 2021)

According to Mulambe, S.O (2017) the overloaded teaching timetable can discourage the integration of technology in teaching practice since it doesn't release time for preparing lessons and searching relevant information to use in teaching. In the similarity with the findings of Chowdhury (2018), many teachers do not complete information in the slide because they don't have time to revamp teaching learning components in accordance with technology. In addition, the lesson period is very short for schoolteachers to incorporate ICT because they spent most of the class time arranging the power point presentation and they cannot offer students the opportunity to use computer in ICT oriented class. This is like the findings of du Plessis, A., & Webb, P. (2012) who stated that one of the obstacles of incorporating technology in teaching is the insufficient of classroom time for students and teachers to use computers. As assumption, the class time is not enough for the efficient incorporation of ICT in teaching and learning activities.

To sum up, teachers' technical knowledge and skills and the conditions that surround and shape their ICT practices, administration procedures and time, are the main factors influencing the use of effective use of Smart classrooms in education.

2.8. Strategies to effectively use Smart classrooms.

Integrating technology devices mainly the internet and computers into educational process has become an important issue. Countless countries have become entirely engaged in using the internet and computers as educational tools. Various reasons promote this trend such as the relative accessibility of computers, the ever-increasing simplicity of using computers, and the large presence of web-based learning applications.

Yang et al. Smart learning Environment (2018) in the research entitled "Evaluation of smart classroom from the perspective of infusing technology into pedagogy". The survey confirmed that configuration of internet connection and digital resources for each student in classroom were fundamental for promoting learning experience as they were the base for digital native conducting inquiry and cooperative learning by using electronic resources. The result also proved that pupils did not perceive much smart learning even in tablet classrooms, which implicated that pedagogy fit was the key issue for the application of smart classroom. Technology devices plus advanced pedagogics could lead to the transformation of teaching and learning patterns. The result also confirmed that demonstration of students' learning results played a crucial role for student's perception toward classroom climate".

Knowles & Kerkman (2011) conducted a survey among students taking part in an introductory online art course that had the goal of detecting if the outcomes of an online course were the same as a traditional face to face course. This study reviewed the interest of students, attitude, and self-organization as three different aspects. The result revealed positive changes in the attitude toward online education at the end up of course. additionally, the aspects that influence learners' contentment in online education have also been scrutinized. By this research, pupils' anxiety hinders the fulfilment of their wishes, but assisting students increase their confidence in the use of computers and make online education more interesting. Besides, they state that a basic computer course may be a precondition to better prepare pupils for online learning.

According to Firmin et al., (2013) in their publication entitled history and implementation of classroom technology, using smart classrooms help to create a rich, students-centered learning environment with a vast variety of wonderful opportunity for students-centered learning (DenBeste, 2003). Furr et al., (2005) acknowledged the benefit of education technology including but not limited to enlivening the classroom setting, stimulating learning, providing immediate feedback, allowing students to work in small groups with their peers either in the classroom settings or globally and creating a classroom environment whereby the teachers 'role is that of facilitator rather than lecturer.

2.10. Influence of school leaders and leadership style in developing the use of Smart classroom.

The work of Dawson and Rakes (2003) on the effect of leader's Technology Training on the Incorporation of Technology devices in School" with intent to oversee if the training a principal obtains concerning technology can influence the utilization of technology in the education process at the trained principal's school. The study showed a necessity to train school leaders about the importance of technology incorporation as they have considerable influence over how much technology is incorporated in the classroom. In this work two additional remarkable factors influencing technology have been the age and level of experience of the school leaders. He concluded that a school leader's influence vis-à-vis technology incorporation is a crucial element since the school leaders are the only ones who make decisions on how human and capital resources are allocated in the school, the focus of professional development and finally the expectation of the staff toward the integration of technology in education activities.

The study of Honeycutt (2013) concerning the effects of leadership practices on sustaining a technology innovation, pointed out nine key implementation factors aimed at improving student's achievement through technology integration. However, the most critical factor was the school leader's ability to bring and lead change. The role of school leadership was taken as an indispensable aspect for the effective integration of technology in the education activities.
The study of Irving (2006) on "the Impact of Educational technology on student's achievement, indicates that the main benefit of the utilization of information technology programs in the classroom is "their readily accessible stores of data.

According to MUSHIMIYIMANA (2021) in his research on school management and efficient use of Smart classroom in teaching and learning process in Rwandan schools, he revealed that school leadership plays great role on the efficient use of Smart Classroom. To him, there is a correlation between school leadership style and the efficient use of Smart classroom. Some school leaders use bureaucratic style whereby they used to remain in the office signing documents and doing reports by computers and other office work. Consequently, they do not move around the school compound overseeing how situation is and observe if smart classrooms are effectively used. They cannot know whether computers are working or if they were stolen.
Some school schoolteachers also show nepotism and despotism along with teachers. Some teachers request for computer to use but schoolteacher deny giving it to that teacher while other get it easily. Besides, some school leaders apply dictatorship and others laissez faire style, and it became an obstacle to the teachers to simply get school equipment properties including computers.
In addition, some leaders use authoritative leadership they broke collaboration between them and teachers. They release computers not because they are needed by teachers and students but because it is time to release it.

To sum up, the Literature Review above focused on the smart classrooms as one of the strategies to integrate technology into different corners of the education system. It highlights the information from different researchers on teachers 'and students' perceptions in line of utilization of smart classrooms in teaching and learning. Indeed, it described smart learning environment and revealed that the learner is the heart of smart learning environment, and the goal of smart learning environment is to provide self-learning, self-motivated and personalized services which learners can attend courses at their own pace and are able to access the personalized learning content according to their personal difference. Furthermore, it identified the barriers that hinder the proper

utilization of technology in education, namely lack of teachers' competence, lack of access to resources, administrative procedures, and rigorous measures to protect computers. However, school leaders' influence regarding technology integration plays a relevant role in proper utilization of school resources including computers, hence they are the ones who have a final say.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

It was necessary to design the research methodology, since it helps to clarify the process of field work and the reason for choosing some methods that will lead to dependable findings. To maintain the trustworthiness, the investigator briefed participants on what their involvement in the research entailed, the requirements of the study and its significance to get their permission before advancing with collecting data. While explaining to the respondents the aim of the study, the researcher did not force anyone to take part in any way but allowed individuals to decide whether to partake in the study. In addition, data was presented in aggregate form and the privacy of respondents was taken into consideration and no person has been harmed or would be harmed as result of this work. Furthermore, the area of the study, the research design, target population, the sample and sampling procedures, research instruments, as well as data collection and analysis procedures has been described in this chapter.

3.1. Area of the study

This study was carried out in Huye District, one of eight district that make up Rwanda's Southern province. Huye boarders with Gisagara district in the east and South, Nyanza district in the North, Nyamagabe in the Northwest, Nyaruguru in the southwest. Presently it has 4 prenursery, 99 Preprimary, 109 Primary, 47 General Secondary, 10 TVET schools, and 5 high education institutions (Education Statistics data, 2021). Among the secondary schools which are the focus of this study, 44 schools are public, and government aided with a total of 23,292 students under general education, while 6 TVET schools are public with 1214 students. One of the reasons of the selection of Huye District as the area of the study, is firstly its brand, which is a hub of education and cultural heritage. This implies that it is a region designated to provide high quality education in a context for knowledge production and innovation through education and training. Additionally, Huye district is a home to the university of Rwanda since it has the oldest university in the country. As of now 30 secondary schools have benefitted from free distribution of computers, screen projectors, internet connectivity by the government to be used in the smart classrooms. Due to this, some teachers have been started to use smart classrooms as teaching and learning materials and it is from this background this work will be done in Huye District to highlight teachers and students' perceptions on the use of smart classrooms in secondary schools.

A secondary school in the Rwandan context, is a school that offers a secondary education, which is an education that last six years whereby the officials age is ranged from 13 to 18 years. It ends with a national examination which yields eligibility for university studies (Mineduc,2016). In Rwandan secondary schools there are professional teachers who are the teachers with bachelor's degree or diploma in teaching from a recognized institution, and non- professional teachers without a degree in teaching from a recognized institution. Both are permanent teachers and receive equal benefits from the teaching job.

The figure bellow indicates the district map of Huye District.

Figure 1: Huye district administrative

3.2 Research design

Research design refers to the techniques that are used by the researcher to determine a sample, manage the instruments, and analyse the data. Research design helps to facilitate the smooth of different research activities or operations by making research as efficient as much as possible which yields maximum information with very low expenditure of efforts, time wastage and low cost. Therefore, this study used mixed methods approach, which is a combination of both quantitative and qualitative method with exploratory research design. This type of design was applied for the fact that smart classroom initiatives are new worldwide and not enough studies were carried out. By using exploratory research design, qualitative data will be first collected and analyzed, and then quantitative data will be collected to explain relationships found in the qualitative data. This means that open ended questions about teachers and students' perceptions have been asked in qualitative way but were completed by closed ended questions to assess the frequencies of respondents on every theme. However, every research method (qualitative and quantitative) has its own strengths and weaknesses, hence the strengths of one type complement the weakness of other one while combined in one study. The table below presents the comparison between both quantitative and qualitative methods.

Table 2:Comparison between quantitative and qualitative research (Queirós.at all,2017)

Aspect	Quantitative research	Qualitative research
Emphasis on the phenomenon studied	Smaller	Bigger
Length of the group studies	Smaller	Bigger
Distance between researcher and the problem	Smaller	Bigger
Time scope	Immediate	Longer range
Position of the researcher vis a vis the problem	External	Internal
Research framework	Well structured	Less structed
Suppleness and exploratory analysis	Lower	Higher

According to Cresswell (2007), mixed methods design gives a thorough grasp of the investigated phenomenon than what is given by either qualitative or quantitative method alone and Queirós (2017) concluded that combining both qualitative and quantitative methods in one study provides

more results than using one method. The purpose of using mixed methods design for this research was to offer a better grasp on the teachers and students' perceptions about the use of smart classrooms.

Cresswell (2014) highlighted three main categories of mixed methods approach and in this study the researcher followed a concurrent Triangulation Mixed Methods, also called convergent parallel Mixed Methods design

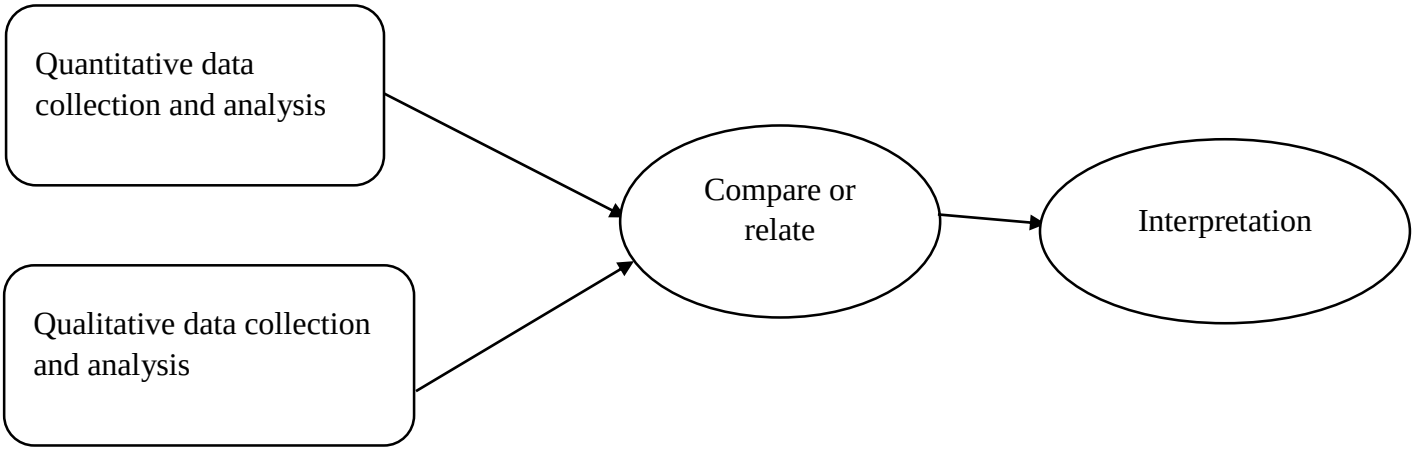


Diagram 2: Convergent Parallel Mixed Methods design from Cresswell (2014)

3.3. Population of the Study

The target population of this study stands at 57 head teachers, 607 teachers and 23292 students in all secondary schools. The accessible population in which sample was taken, comprised of 30 head teachers, 30 deputy head teachers in charge of studies, 404 teachers, and 17,692 students. *(MINEDUC, education statistics, 2021)*

The head teachers and deputy head teachers in charge of studies are important in the study since they are firstly responsible for the general running of the school. Secondly, they make crucial decisions about their schools, including the appropriate teaching and learning process, thirdly they carry out administrative tasks. Teachers are the implementers of the school curriculum and first users of Smart classrooms. The students are the natural consumers of school policies and therefore may provide relevant feedback on how they appreciate or depreciate the new strategy that involves the effective teaching and learning process.

3.4. Sample and sampling procedure

Teachers and students who participated in this study were selected using Slovin's formula hereunder:

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

n = sample size **N** = Target population e = significance level (Error margin)

Furthermore, the number of teachers and students was selected for the study at 5% level of significance.

Schools were sampled using purposive sampling. The only 20 public and government aided schools were purposively selected from the pool of 30 eligible secondary schools across the district for they were equipped with smart classrooms by the government of Rwanda. Therefore, teachers were equal to $\frac{404}{1+404(0.05)^2}$ = 192 while students were $\frac{17692}{1+17692\,(0.05)^2}$ = 393

Besides, 20 head teachers and 20 deputy head teachers in charge of studies were purposively selected to participate in the study.

3.4.1 Non-Probability Sampling

This research used different techniques such as purposive sampling and convenience sampling. the above strategies were used due to its influency in their valuability in exploratory studies. This research prefered non probability sampling due to its importance in providing chance of choosing different samples based on individual judgement considering respondents characteristics.

Convenience sampling deals only with choosing people for a sample who are the most accessible. Sometimes the particpants taken are known as the one who can provide relevant information and it is easy to reach them. (Dudley, 2011). As the writter puts it, this sampling technique has setbacks due to advantages seen by the reasearcher.

Basing on the setbacks of this sampling methods, it was only utilized in prior study in order to have validity in the research only important data that is provided to some people. For achieving our target 10% of the total sample was taken and used in the research analysis for enriching the research .

Purposive sampling: according to tongco (2007) this non-probability sampling is mostly used by choosing the respondents that you find are important in in the reaesrch considering their

skills,and judgement even how they are honest. Purposive sampling is applied in areas where the skills of an authority can choose a more reliable test that can bring more exact results than by using other probability sampling methods. This technique hepls the reaesrcher to identify the respondents that you find may provide relevant information. As said above, head teachers and deputy headteachers were choosen using this approach.

For this research, the hollistic criteria for students and teachers are the following: two years in the selected school, reachable in the time of data gathering, free and voluntarily participating. The table bellow give details on the sampled schools, teachers and students

Table 3:Table indicating number of sampled schools, teachers, and students.

No	sampled schools	Number of computers in the smart classrooms	computers for teachers	Total	Nbr of Students	Nbr of teachers	Sample teachers	Sample students	Nbr of sampled head teachers	Nbr of sampled DHT in charge of studies
1	GS KARAMA	100	5	105	876	24	12	29	1	1
2	ES Mbogo	100	5	105	334	13	7	13	1	1
3	GS Gishihe	100	5	105	663	24	12	22	1	1
4	GS Kinazi	100	5	105	1001	24	12	33	1	1
5	GS Kabuye	100	5	105	522	22	10	17	1	1
6	GS MUGANO	100	5	105	483	12	6	16	1	1
7	ES Mutunda	100	5	105	467	13	7	15	1	1
8	GS NKUBI	100	5	105	778	24	14	25	1	1
9	GS O Butare	100	5	105	1199	44	21	39	1	1
10	ENDP KARUBANDA	100	5	105	707	25	8	23	1	1
11	GS GATAGARA	100	5	105	386	19	6	13	1	1
12	GS BUTARE CATH	100	5	105	527	24	14	17	1	1
13	CJSM	100	5	105	527	12	6	17	1	1
14	ES KIRUHURA	100	5	105	526	17	8	17	1	1
15	GS Kotana	100	5	105	348	12	6	12	1	1
16	GS Sheke	100	5	105	290	8	4	12	1	1
17	E. S Simbi	100	5	105	365	15	9	13	1	1
18	GS CYARWA	100	5	105	492	18	7	16	1	1
19	EAV KABUTARE	50	0	50	841	34	14	28	1	1
20	RWABUYE TVET	30	0	30	466	20	9	16	1	1
TOTAL		**1880**	**90**	**1970**	**11,798**	404	**192**	**393**	**20**	20

3.5. Validity and Reliability.

Validity is the accuracy with which an instrument measures what it is intended to measure and yields data that really represents reality whereas reliablity on the other hand refers to the measure of consistency. (Kvale, 1996). The researcher made questionnaires and personally administered with on-spot-collection to ensure the clarity, simplicity, reliability, and validity in actual research.

To ensure validity and reliability, researcher designed survey questionnaire and it was pre-tested in three schools. Modification were made upon the feedack from this pre-test to make the questionaire more effective, more consistent, and more understandable.

The researcher also invested diligent efforts and commitment to consistency throughout interviewing, recording, paraphrasing, and analyzing each stage of the interview that was conducted.

3.6 Data Collection Methods and Instruments

Data is anything that is produced as a result of research. (Oso , 2008). Both secondary and primary data were taken into consideration.

3.6.1 Secondary data.

Secondary data is the information gathered from the available documents like books written in relation to the topic under investigation. (Oso,2008).

Document assessment was implemented by the use of books of key writer, official reports, hard and online journals.

3.6.2 Primary Data

This data is gathered at first hand when the researcher himself collect them from the field of interest. Different techniques were used in collecting primary data such as the following

(i) Questionnaire Administration

Questionnaires are the main of research tools for discovering people's thoughts, experience, attitudes, and orientations to future action. (Creswell, 2009). Questionaire of this study was designed in accordance to the research objectives. Questions were formulated , typed and printed out and it was filled by the school heads, students, and teachers.

Table 4:Way of designing a questionnaire

stages	**Explanation**
Stage 1	Description of the respondents and subject of interest
Stage 2	Information on expected time time for a questionnaire to be filled
Stge 3	Giving questionnaire to the respondents
Stge 4	Helping the respondents to understand well the questionnaire
Stge 5	In case of any challenges upon a certain items, give a response: " a questions should e answered according to interpretation; if more clarification is needed, guidances should be given
Stge 6	Collecting all questions of the respondents on the questionnaire and write them
Part 7	Thanking the respondents after filling the questionnaire

Source: Siniscalco and Auriat (2005)

(ii) Focus Group Discussion

Focus group discussion (FGD), was often used in qualitative research. FGD allowed the researcher-interviewer to ask many individuals step by step and concurrently (Rubin and Babbie, 2005). A focus group discussion (FGD) is a good way of collecting people from the same feature to elaborate a specific topic of interest (ODI Toolkits, 2009). In this research each team of five deputy head teachers were oriented by a researcher who primarily and foremostly give topics for discussion and guided the group to get involved actively and naturaly.

(iii) Interview

Rubin and Babbie (2005) indicated that field research is a pont of go to where an act is and simply observe and listen. Similary, field research can accomodate more active questions at times, it recommends people to ask questions and keep the responses. The process of exchanging with interviewees and posing questions is called interview.

The kind of interview was administered in this study and it was semi-structured interview mode. Dudley (2011) asserted that in this sort of interview, the vast majority querries are instructured, but they can be asked in a diverse sequence.

Hence the main role of interview is to discover the ideas , knowledge and beliefs of individuals about a specific topic, the researcher used open-ended questions to get an extensive knowldge of the topic of the research and fill the collected information through other research instruments.

In this research, five deputy head teachers in charge of studies and fifteen teachers were selected from 5 schools and participated in the interview, as the interview was conducted after collecting data with questionnaires, the five secondary schools were purposively selected among the 20 eligible schools after brief scanning of the filled questionnaires. From each school one deputy head teacher was selected for the interview and three teachers were randomly selected from eligible teachers of each of five schools.

3.6 Methods of data analysis

After obtaining data from the field, results have been analysed by using different techniques such as qualitative and quantitative where Univariate analysis, Thematic analysis and Content analysis, Statistical Packages for Social Sciences (SPSS) has been used for tables and figures even Ms Word.

3.6.1 Univariate Analysis

This approach was applied to change what is gathered or seen into numerical data. Closed-ended answers have been shown by numbers. Numeric information gained, were used with the statistical package for social sciences (SPSS) and Ms Excel. Such style facilitated the investigator to give results into frequencies and graphics by presenting the number and percentage for each variable worked upon. Rubin (2005) has set the univariate analysis as the testing of the allocation of cases on only one variable at a once. The format for displaying univariate data is to report all individual cases; that is, to enumerate the attribute for each case under investigation as regards the variable in question. The process of univariate analysis described below was the outcome of the study of Bernard (2000).

Table 5:Process of doing analysis by using univariate approach

Stages	**Procedures**	**Outcomes**
Step 1. Editing	Citing and electifying typing errors	Meaningfull data
Step 2. Grouping	Data obtained for every variable was recorded	Accessibility of result for every variable
Step 3. Tabulating	creating of frequency tables and graphs, Number of cases shown were marked with the population as a part of the total population frequency of criterion variable divided by N.	classified and unclassified frequency allocation
Step 4. Interpretation	Attributing words to arithmetical information	Data grouping and explanation

Source: Bernard (2000)

3.6.2 Thematic Analysis

For qualitative data, thematic analysis is the most known form of analysis. It stresses identifying, testing and taking patterns (or "themes") within the data (Braun and Clarke, 2006). Themes are patterns along data sets that are useful to the explanation of a phenomenon and are attached to a specific research question (Daly, Kellehear and Gliksman, 1997).

Thematic analysis is done through the procedures of coding in six steps to create established significant patterns. These procedures are: getting used with data, creating initial codes, slooking for themes among codes, revisiting themes, clarifying and naming themes, and creating the final report (Fereday and Muir-Cochrane, 2006). The thematic analysis procedures that was used by the researcher is presented in the Table bellow:

Table 6:Thematic Analysis Process

Stage	**Procedures**	**Outcomes**
stage 1: Acquaintance with data	Carefuly Read the data to become conversant with what the data contains and paying much attention to what patterns happened.	Initialy "start" codes and expanded notes
Stage2: creating basic codes.	Creating the basic codes by recording where and how patterns happened. This took place through data breakdown where the researcher classified information into labels with the aime of creating classes for more efficient analysis.	Comprehensive codes of how data answers research question.
Stage 3: Looking for themes within codes	joining of codes into matching themes that clearly represents the data. It is useful in creating themes that the researcher explained what the themes mean through matching information	Number of themes for deeper analysis.
Stage 4: Revising themes	the researcher considerd how the themes were in line with the information. If the analysis was not finished , the researcher reviewed to find out what was lacking.	Systematic understanding of how themes are patterned to give a clear story about the information.
Stage 5: Describing and labaling themes	The researcher described what each theme was, which areas of data were taken, and what was important about the themes.	An extensive analysis of what the themes added to comprehand the information
Stage 6: Giving the final report	When the investigator compiled the report, he chose which themes make important attribute to comprehending	Explanation of the outcomes.

	how society development project contributed to the economic empowerment of households headed by the female. Linking the concepts of respondents with the specific and the general objectives of the study.	

Source: Fereday, Jennifer &Elimear Muir-Cochrane (2006).

Thematic analysis has been majory applied to show and analyse information from interview, focus group discussion and observation. The results recieved with those systems have been complemented by results gained with questionnaire administration. The results from questionnaire have been analysed through content analysis as expanded below.

3.6.3 Content Analysis

Content analysis is used to make valid inferences by interpreting and coding textual material. By systematically evaluating texts (e.g., documents, oral communication, and graphics), qualitative data can be changed to quantitative data.

This technique allows the researcher to take large content of textual message and systematically identify its properties, such as the frequencies of most used keywords by locating the more important structures of its communication content. Such amounts of textual message must be classified to provide a meaningful reading of content under consideration.

Content analysis is a class of research approach at the point of the qualitative and quantitative aspect. It is encouraging for dificulty finding of many useful but challange-to-study cases of attention to orrangemental researchers in cases as different as business policy and strategy, managerial and organizational cognition, , human resources strategy, organizational behaviour, technology and innovation management ,social-issues management, organizational theory, and international management, (Duriau and Pfarrer, 2007).

Table 7:Content Analysis Process

Stages	**Description**
Stage 1. Organization and management of answers	Good management and organization helps the research to make proper analysis Information related to respondents are well recorded for better analysis
Stage 2. Finding and interpreting common, ongoing and unplanned themes	Once all the categories of interviews have been carried out and the record kept, the interviewer can revise the information in order to find usual, onging, or unplanned themes. This can also be where you dismiss information that is not usefull to the questions you need to respond to. Find out important themes and their codes in the information gathering format.
Stage 3. Recording answers and coding the information	Findings can be recorded using the question number or question tracer. It is better to enter one theme per line to help coding, especially if respondents had both positive and negative answers to a question.
Stage 4. Treating patterns amongst themes	Find out similar characteristics between respondents who discuss the same themes. Treating patterns allows the evaluation to move from description to an analitical level.
Step 5. Presention of evaluation	Give the findings of your analysis by identifying patterns, what this stands for in the project and it is better to add quotation from respondents to support analysis and interpretation.

Source: Robertson (1976); Duriau and Pfarrer (2007)

This mixed research technic has assisted in presenting findings by putting together, opposing and/or complementing the information from the findings gathered and analysed.

CHAPTER FOUR: DATA ANALYSIS, INTERPRETATION AND PRESENTATION OF FINDINGS.

4.0. Introduction

This chapter presents the results undertaken from students, teachers, and head teachers in the framework of the set study questions. It presents the rate and characteristics of respondents sampled in 20 schools of Huye District under which smart classrooms have been established.
The methods used for data collection were a survey of 192 teachers, 393 students and 20 head teachers using the questionnaires, interview with 5 deputy head teachers in charges of studies as well as 15 Deputy head teachers in charge of studies with Focused Group Discussion. After distributing the questionnaires, only 170 teachers responded to the questionnaires. However, all students and head teachers returned the well filled questionnaires. Also, all deputy head teachers in charge of studies participated in the interview and focused group discussion as expected.
The findings presented are guided by the following research focuses:

i. The teachers and students' perceptions towards smart classrooms in secondary schools.
ii. The types of learning and teaching activities performed by teachers in the smart classrooms.
iii. The possible challenges regarding smart classrooms and related mitigating strategies.

4.1. Rate of respondents

The researcher distributed a total of 583 questionnaires to the sampled students, teachers, and head teachers from 20 Secondary schools in Huye District. Yet, 583 respondents returned their questionnaires to the researcher. This is equivalent to 100% of the rate of return. According to Owens (2012), a return rate of above 75% is allowed to represent a study hence it helps in reducing the level of sampling bias.

4.2. Demographic characteristics of respondents

The demographic characteristics of the participants are gender , ages, marital status and the Educational qualification.

4.2.1. Gender of the Respondents

Table 8:Gender of the respondents

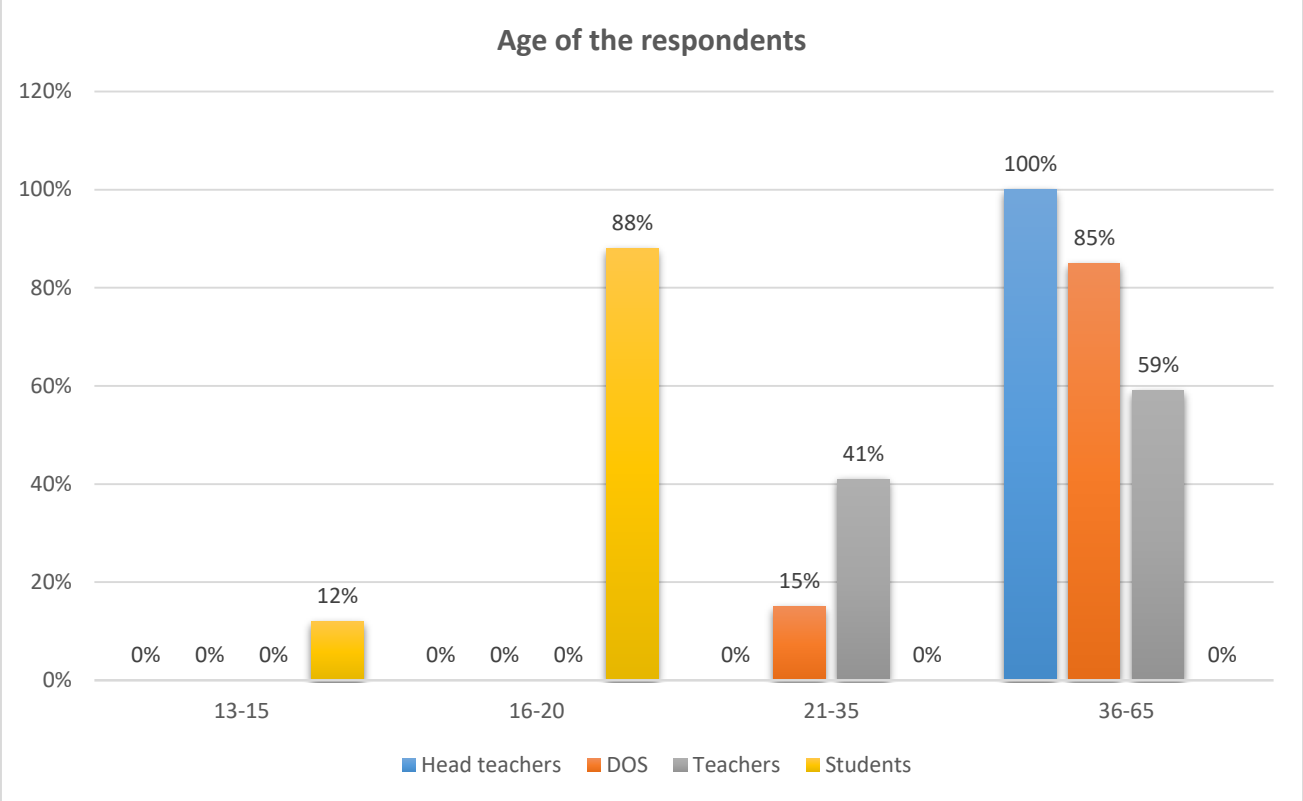
Respondents	Gender of the respondents			
	Female		Male	
	Frequency	percentage	frequency	percentage
1.Head teachers	3	15%	17	85%
2.DOS	7	35%	13	65%
3.Teachers	39	23%	131	77%
4.Students	200	51%	193	49%
Total	249	42%	354	58%

Source:Primary Data 2021

Based on the results presented in the table above 4.1 we find both male and female participated in the research where 42% are female and 58% are male. This percentage shows that at secondary level we have both male and female among head teacher,teachers and also among students and once the views are obtained from both sex it will lead to obtain accuracy data. Briefly we see that among head teachers we have female and male at a percentage of 15%, 85% respectively,for Deputy head teachers in chargeof studies we have a percentage of 35% of female and 65% of male, among teachers we have 23%,77% female and male respectively and lastly female students occupied 42% and male take 58% among the schools selected for getting information on perception of smart classroom in secondary schools.

4.2.2. Age of the respondents

Figure 2:Age of the respondents

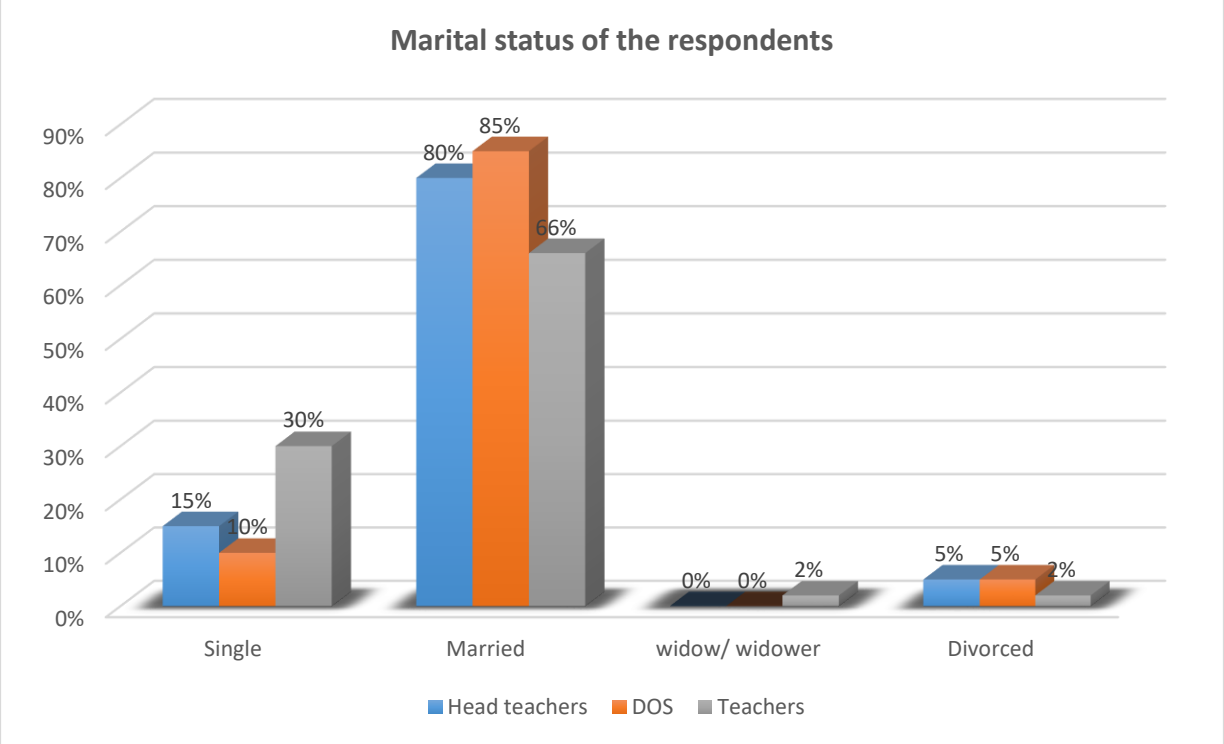


Source:Primary Data 2021

Due to the information provided by head techers,deputy head teachers in charge of studies ,teachers and students we sumarized them by using a column graph where we find that a big part of students involved in the research are between 16-20 years old,followed by these who are in the range between 13-15 years old this shows that most of the students who are in secondary are still young and with smart classrooms this may help them to accomplish their studies,on another hand of teachers we find that teachers who are in secondary schools are aged between 21-35; 36-65 with 41%,59% respectively and this will contribute in education because even teachers are not old, also we have deputy head teachers whose ages are ranged in the interval of 21-35; 36-65 with 15% and 85% respectively, lastly we have head of teachers who are ranged in the interval of 36-65 years old and this is due to experience gained by them because most of them start their career as teachers but due to the time and may be to performance they become headteachers that is why most of them are in the range of 36-65.

4.2.3.Marital status of the respondents

Figure 3:Marital status of the respondents

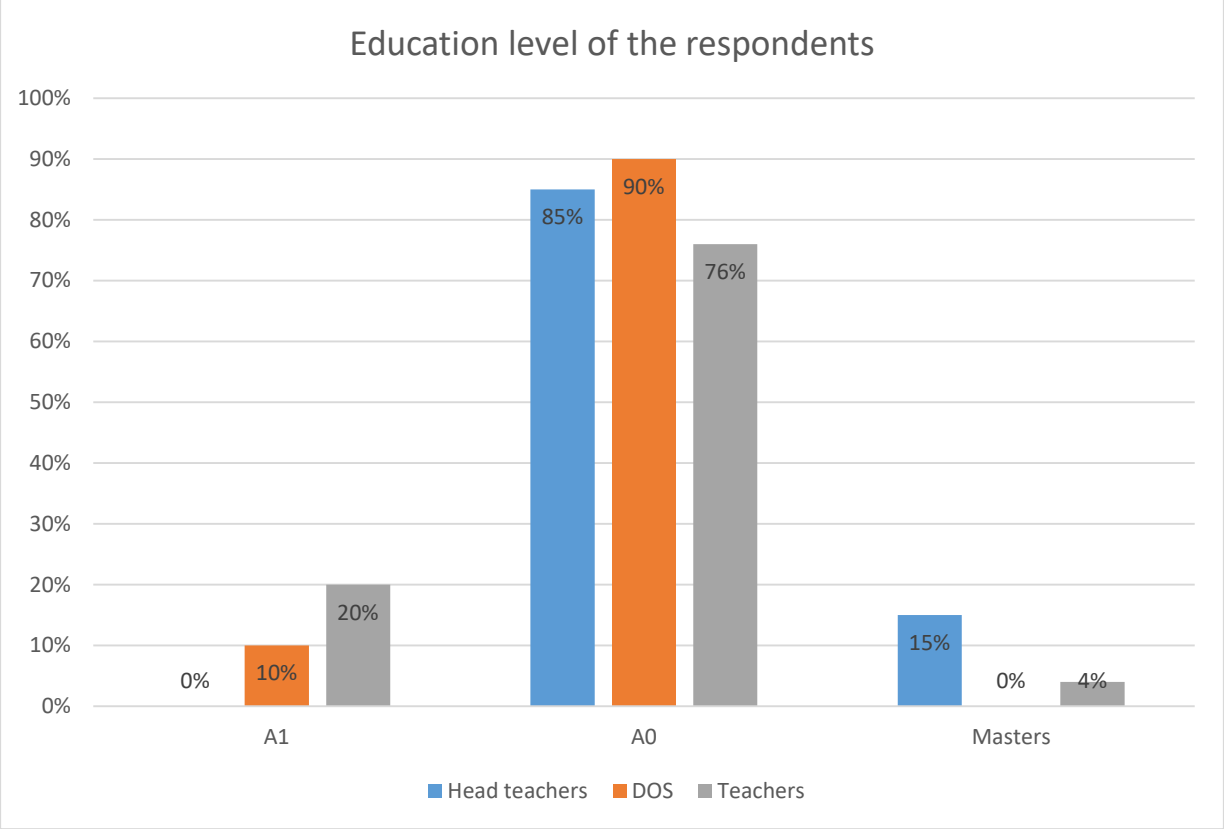


source:Primary data 2021

According to the results presented in the figure above 4.2 we see that both head teachers and teachers have different status that make them mature who are able to understand perception on utilisation of smart classorooms in secondary schools this is shown by the percentages where among teachers 80% are married,15% are single and lastly few of them are widow at 5%,while 10% deputy head teachers in charge of studies are single,85% are married 5% are divorced. On the other hand of teachers, 66% are married,30% are single and 2% are divorced and widower for the same rate and as you can see we did not focus our concern on marital status of students because due to their age in the figure 4.1 we found that they are not above 20 years old and this put all of them in having the same marital statuds of being single.

4.2.4.Education level of the respondents

Figure 4: Education level of the respondents



Source:Primary data 2021

Based on the findings during the research ,most of the teachers in selected school in secondary have A0 at a percentage of 76%,followed by those who have A1 at a percentage of 20%,and lastly we have 4% who have masters degree,on the side of deputy head teachers in charge of studies, 90% have A0 degree whereas 10% have A1 degree. On the side of head teachers, we have 85% who have A0 and 15% who have masters degree even if at secondary level the recognized degree is up to A0 but some head teachers and some teachers prefer to continue their studies up to masters degree and this may contribute in the school performance in case the concerned has followed the same option or related at masters level. Briefly this shows that our research has head teachers and teachers who can let us know how smart classroom is used in secondary level because they can understand the importance of the reasearch due to their education level.

4.2.5.Class distribution of the students

Table 9:Classes of the students

Type of education	General Education						TVET		
classes	S1	S2	S3	S4	S5	S6	L3	L4	L5
frequency	20	55	86	39	51	102	4	16	20
Percent	5%	14%	22%	10%	13%	26%	1%	4%	5%

Source:Primary data 2021

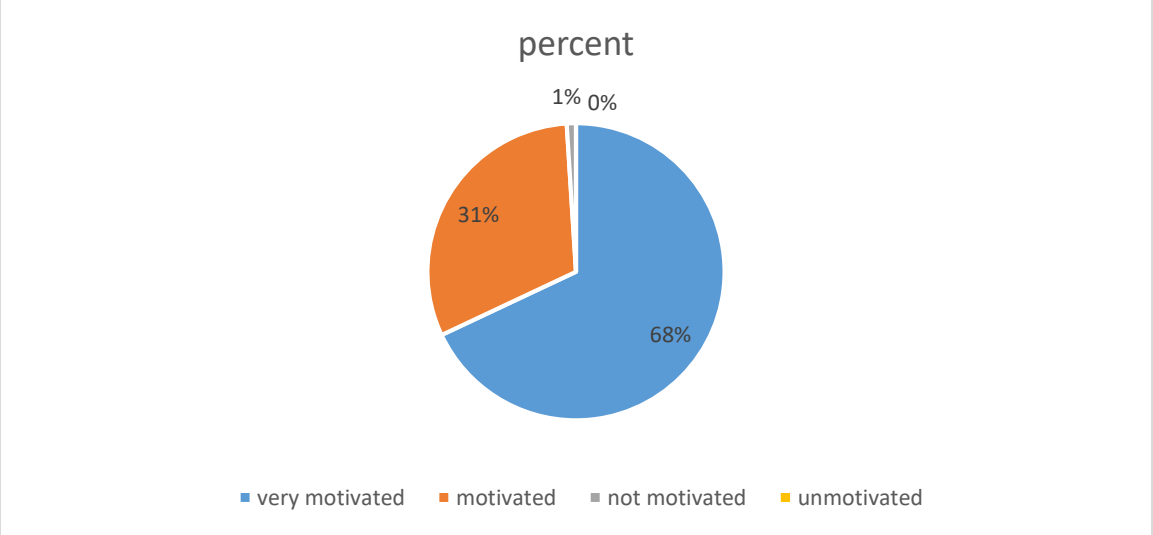
Based on the table above 4.2 it is seen that students who participated in the reseach have been taken from different classes for both general education and TVET and this contribute more in the research because it shows that students from different classes are giving their views on utilisation of smart classroom in secondary schools,as you know when we take views from different people we get more crucial information.

4.3 Findings on the objectives

4.3.1. In relation to teachers and students' perceptions towards smart classrooms in secondary schools

4.3.1.1. Perception on teaching and learning process

Figure 5: Perception students on teaching and learning process that took place in the smart classroom by using technological devices.



Source: Primary data 2021

Based on the results in the figure above 4.4 the researcher finds that most of students in the research said that they are very motivated on teaching and learning process into smart classroom by using different technological devices where they are represented by 68%,followed by those who are motivated at a percentage of 31%,1% for not motivated based on their views from them it was found that learners are very motivated when they are using smart classroom because it helps them to pay attention on the course and as using ICT in teaching in Rwanda is considered as new that is why it motivates students. With this smart classroom, teachers must use this opportunity by encouraging students to be active and participate in the course that may lead to good performance of the students that lead to increase in their knowledge.

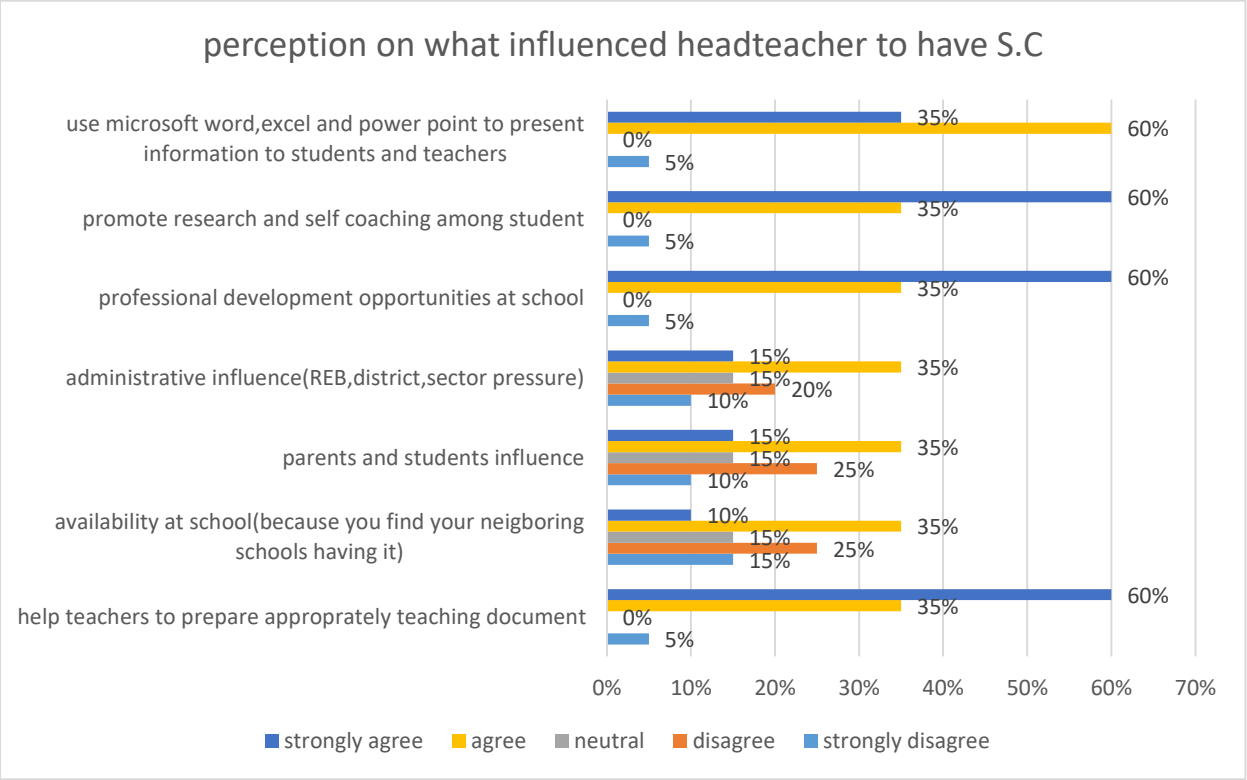
In addition to the numeral data collected via questionnaire, one headmaster, during an interview, said that "*Our schools are now equipped with two Smart classrooms, thanks to Rwanda Education Board, we set rules that every subject must be taught in the Smart classrooms at least one period a week. Also, students are allowed to use Smart classrooms during the free time. The management of the school has elaborated a timetable that teachers and students must follow. Apart from these, the establishment of Smart classrooms in our schools facilitated in student's management by using different systems developed by MINEDUC and REB. For instance, Smart Classrooms helped in transferring students from one school to another through MINEDUC's online based system known as School Data Management System (SDMS), teachers also can be transferred from one School to another by using REB's online based System known as Teacher Management Information System (TMIS). In general, Smart classrooms are being used as a tool of learning for both students and teachers and we are hoping to see more excellent results in the coming years. Also, they are helping schools in accomplishing the administration tasks.*

Another teacher said: "*Smart classrooms are now helping teachers to improve learning and teaching activities. Teachers and students are now using internet for their own leaning and searching various teaching resources related to the curriculum and learning teaching materials. They used to download videos, images, and documents. In addition, when students are given opportunity to use Smart classrooms, they are very willing to learn than before. To sum up, both students and teachers are very excited about using Smart classrooms".*

This quote affirms that the launch of smart classrooms was well welcomed by both teachers and students, they are eager to benefit from the information technology that is established in the schools.

4.3.1.2 Factors which influenced head teachers to have smart classroom in the secondary school

Figure 6: Figure 4.5. factors influencing head teachers to have S.C



Source: Primary data 2021

As it can be seen in the figure above 4.5. it was found that there are many factors that influenced head teachers to have smart classroom and among them respondents listed some of them such as use of Microsoft word, excel, and power point to present information to students, promote research and self-coaching among students, professional development opportunities at school, administrative influence, parents and students influence, availability of smart classroom in neighbouring schools, helping teachers to prepare teaching documents .Due to deep analysis done as presented in the figure above most of the head teachers decided to come with a smart classroom in order to help teacher prepare teaching documents ,due to influence of students and parents who are complaining it in order to support students 'engagement with collaborative learning, using it in order to present information to students by using Microsoft word, excel, and power point

presentation ,where most of the respondents strongly agree and other agree above 90% and few of them disagree and strongly disagree at a percentage of less than 10%,this is good indicator that shows how head teachers are motivated to bring smart classrooms at their school due to the reasons above.

4.3.1.3 Respondents experience, on how the establishment of smart classrooms align with the Mission and Vision of their schools.

In the group discussion, Deputy head teachers argued that the core business of the school is to promote effective teaching and learning, each school mission and vision turn around the improvement of quality of education, thus introduction of smart classroom in the school is one of the strategies aimed at improving teaching and learning process which is an important point of school vision and mission. According to them, students are being equipped with the skills helping them to learn outside the classrooms, peer learning is being promoted hence students are collaborating with others through different platforms, they are getting different resources from their colleagues of the other schools, additionally smart classroom is a significant motivational factor in the students, once the computers arrived in the school students became active and participative. On the side of teachers, smart classrooms allowed them to have access to most up to date teaching content through various research they are making on the websites and platforms. Furthermore, it is making easier planning and preparation of lessons and sharing resources. To this end, deputy head teachers in charge of studies have positive perceptions toward smart classrooms since they have already recognized the importance of Smart classroom in their schools.

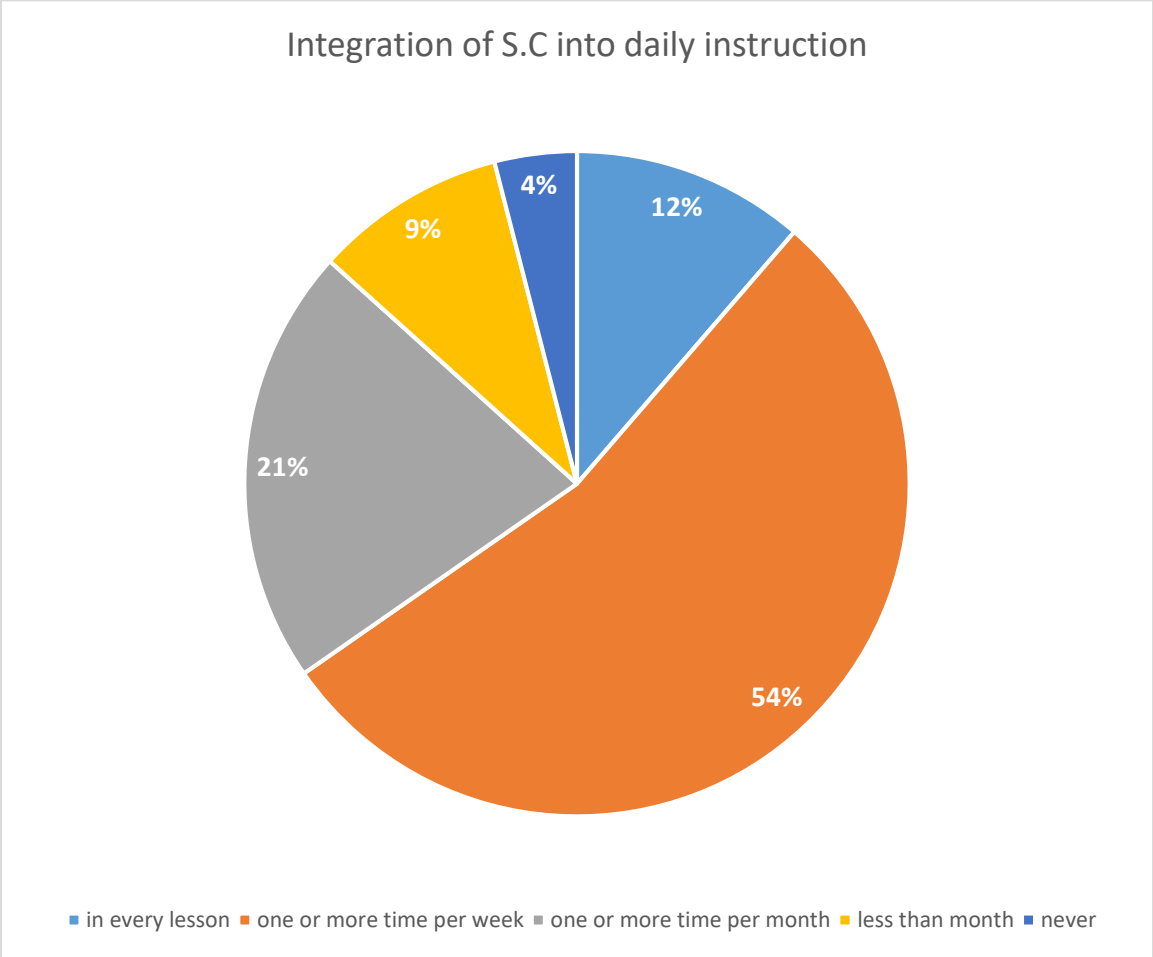
This was evidenced by one teacher who said: "*Smart classrooms enabled teachers to improve their teaching practice, in an efficient way: lesson plans and note get prepared in computers and saved for being reused in the next year. This helps teachers to save time that would be wasted on rewriting the lesson plan as well as notes and easily edit them. Teachers also save a lot of time by projecting images rather than drawing the on the chalkboard or pieces of paper. Also, before the schools acquired computers, there were many mistakes and delays in completing students 'academic reports, and each mistake led to restarting completing school report on a new form because we used to write reports by hands. After having the smart classrooms, the number of reports that used to be completed within a week, as now being done in two days".*

To sum up the establishment of smart classrooms in the schools with the spirit of the integration of technology in the classrooms have the purpose of enhancing the students' understanding and

their attitudes toward learning, which is the main purpose of setting school directions (Mission and Vision).

4.3.1.4 Integration of smart classrooms into daily instructions

Figure 7: Figure 4.6 integration of S.C into daily instructions



Source: Primary data 2021

Considering results from figure 4.6. the researcher observed that smart classroom is integrated in daily instruction in secondary schools where 12% said that they use smart classrooms in every lesson,54% they use smart classrooms one or more per week followed by these who used smart classroom one or more time per month at a percentage of 21%,9% less that one per month and 4% said that they don't use smart classroom in daily instructions. Even if smart classrooms are not involved in daily instructions in all schools in every lesson but the researcher found that smart classroom is used more than 66% one or more time per week and this shows that in secondary schools, smart classroom is being used in teaching and learning process.

4.3.1.5 Influence of teachers to frequent smart classroom

Table 10:What influences teacher to frequent smart classroom and use it in daily life process

Activities	**Strongly disagree**	**disagree**	**neutral**	**agree**	**Strongly agree**
Developing lesson plan and another relevant document	8%	3%	6%	52%	31%
Learning from expert teachers the updated pedagogical skills	5%	3%	6%	43%	43%
Preparing notes, different materials for teaching and learning process	5%	4%	1%	35%	55%
Prepare different activities(assignment) to be provided to students	5%	5%	4%	40%	46%
Search countless information that will fortify my profession, self-learning, collaboration together with updating myself through information and extend my confidence and ability in my subject of specialisation	7%	2%	1%	18%	72%

Source: Primary data 2021

Based on the result presented in the table 4.3, the researcher found that most of the teachers frequent smart classroom when they want to perform some school activities where 40%,46% agreed an strongly agreed respectively, they use smart classroom in order to prepare different school activities such as assignment to be given to the students, developing lesson plan and other school documents where 52% agreed and 31% strongly agree, learning form expert teachers the updated pedagogical skills at a percentage of 86% for both who agreed and disagreed, preparing notes and other materials needed in teaching activities at a percentage of 90%,and the researcher cannot forget that at a percentage of 80% they frequent smart classroom in order to search various information that help them to strengthen their profession. On another hand some teachers did not see any reason among the listed in the table above why they frequent smart classroom even if it is at the smallest percentage where some of them said that they frequent due to the order of headmasters, students influence who need to use internet connectivity, giving notes to the students.

4.3.1.6 Factors that encourage use of smart classroom

Table 11:What influences teacher to frequent smart classroom and use it in daily life process

Factors that encourage use of smart classroom for both teachers and students	**Important**		**Not important**	
	F	**P**	**F**	**P**
Reducing workload to provide opportunities to teachers for developing instructional materials	126	84%	24	16%
Investment on in-service education programs for instructional technologies	141	94%	9	6%
Increase number of smart classrooms	141	94%	9	6%
Equip the whole school with the internet connectivity	146	97%	4	3%
Carrying out the studies for integration of technology into curriculum	137	91%	13	9%
Prepare model lessons in which technology is included	142	95%	8	5%
Rewarding the efforts of teachers towards the use of smart classrooms	133	89%	17	11%

Source: primary data 2021

From the findings of the table above 4.4, the researcher sees that for both teachers and students it is good to encourage them to use smart classroom, but some challenges are faced by them that is why some activities should be done to encourage them. Among those factors that can encourage them, the researcher insisted about reducing workload in order to get enough time for preparing and developing lesson to be provided to the students in smart classroom and also students need to have a time for going and using smart classroom this has been taken as important at a percentage of 84% and it has been considered not important at a percentage of 16%,it is seen also important to provide in service education programs for instructional technologies at a percentage of 94% and 6% finds that it is not important ,increasing number of smart classrooms will be also important at a percentage of 94%,and unimportant at a percentage of 6%,it is also important at 97% to equip whole school with internet connectivity in order to encourage both teachers and students to use smart classroom, they have to integrate Smart classrooms in curriculum 91% said that it is important while 9% said that it is not important, it is also important to prepare lessons that will need to involve technology at a percentage of 95%,on another hand 5% said that it is not important,

and lastly both teachers and students observed that once they reward teachers who uses well smart classroom this may encourage them to use smart classroom. Briefly they are different factors that may encourage teachers and students to use smart classroom as mentioned in the table above.

4.3.1.7 Interest of using smart classroom

Table 12:Interest of using smart classroom in teaching and learning process

Interest of using smart classroom in teaching and learning process	**Agree**		**Disagree**	
	F	**P**	**F**	**P**
Using smart classrooms makes learning more effective	147	98%	3	2%
The use of smart classrooms increased the interest of students	146	97%	4	3%
The use of smart classrooms increased the quality of courses	137	91%	13	9%
Usage of smart classrooms makes it easier to prepare course materials (assignment, handouts etc)	141	94%	9	6%
Usage of smart classrooms helps to handle different learning preferences of students having different learning styles	134	89%	16	11%
Usage of smart classrooms help to search for various information related to teaching	146	97%	4	3%
Assist in oversimplifying learning and teaching activities help in management of time	124	83%	26	17%
Get good, enough, and satisfactory answers when I get difficult questions from students	134	89%	16	11%

Source: primary data 2021

Considering the results provided in the table above 4.5 the researcher observed that using smart classroom has many interests such as to make learning more effective at a percentage of 98% as "*Smart classrooms facilitate in teaching and learning through downloading learning materials and preparation of students' assignments. The teacher projects any subject on white board by using computer and projector. The whiteboard comes with an exciting range of feature that adds a sense of excitement to each classroom session. However, it could be more successful if there is a support of parents",* while only 2% disagreed this statement. It was followed by those who find benefits in increasing the interested student who become more active and participative at a percentage of 97%. This was witness by three respondents who clarified that *"Smart classrooms promote self- study sprit among students as it complements the content provided by teacher while*

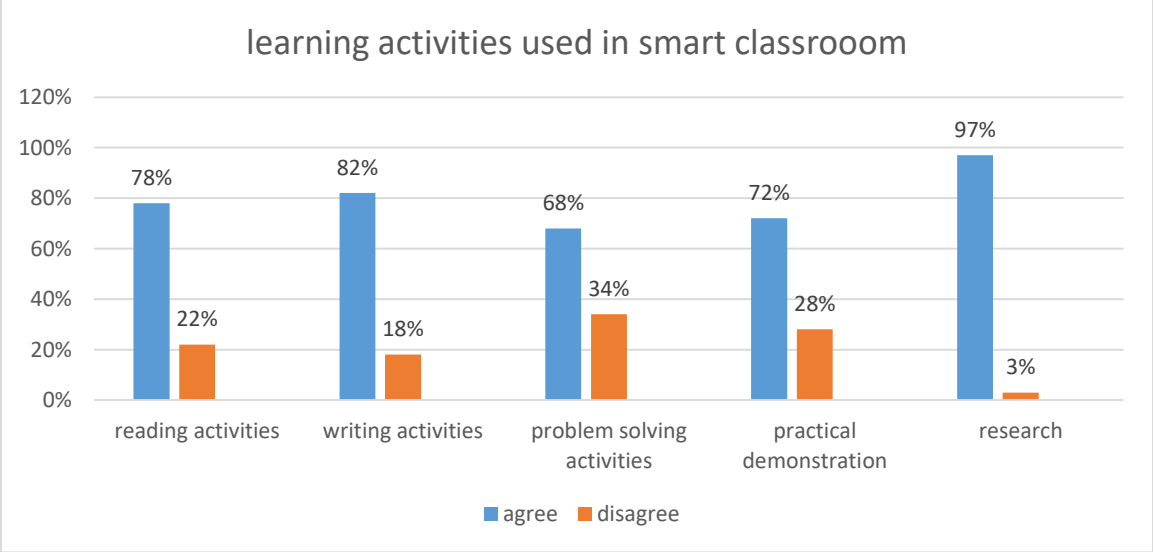
teaching. Many students enrich the content through reading important documents downloaded from different websites"; "*Smart classrooms help students to save lecture notes, without taking down notes excessively. Students and teachers can use the data and images obtained, whenever they want*."; "*Smart classrooms improve students' learning because it promotes personal learning and it do limit choice of learning materials for both teachers and students however, it could be more successful if students have access to computer at home"*

Using smart classrooms helps in searching various information related to teaching at a percentage of 97%. The using smart classrooms helps in increasing quality of courses at a percentage of 91% while 9% disagreed, using smart classroom helps to make easy to prepare course materials (assignment, handouts) at a percentage of 94% as said by a respondent, "Smart *classrooms help teachers for preparing notes and other different materials for leaning namely lesson plans, videos, images and also having access to different information".* Smart classrooms help to handle different learning preferences of students having different learning styles, contributes to simplifying teaching activities and help in management of time, help in getting good answer and satisfactory answers 89%,83%,89% respectively while 11%,17%,11% disagreed respectively. Based on the findings the researcher sees that using smart classroom is very crucial in teaching and learning activity process.

4.3.2 Teaching and learning activities that teachers perform in the smart classrooms

4.3.2.1. Types of learning activities used in classroom

Figure 8: Figure 4.6 integration of S.C into daily instructions



Source: Primary data 2021

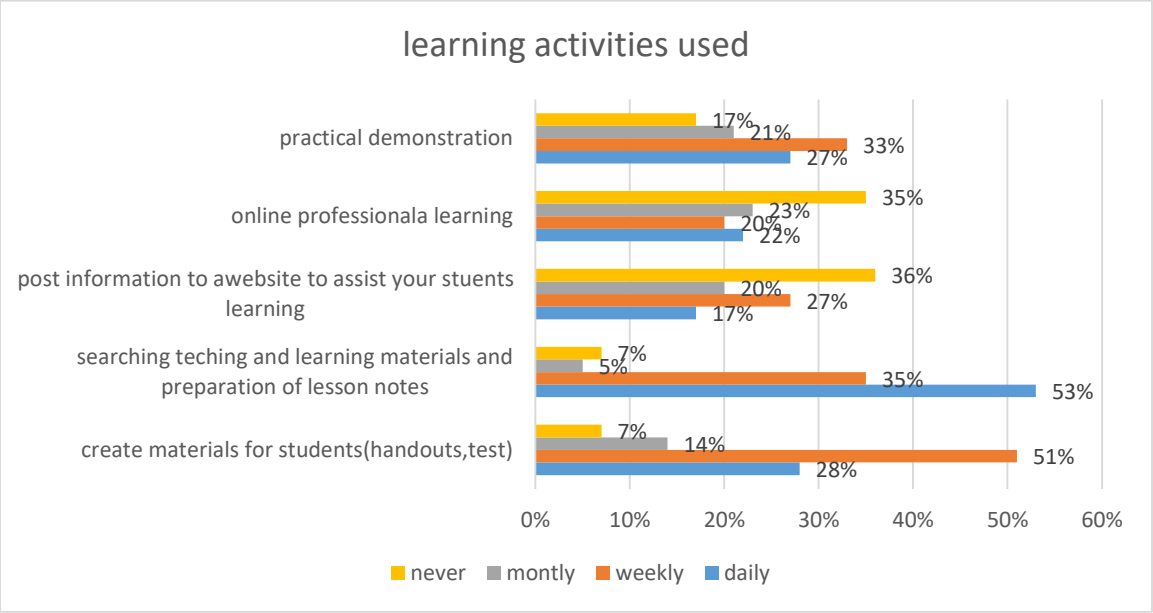
Based on the results provided by the figure 4.7 the researcher found that there are different types of learning activities done in smart classrooms like reading where 97%,3% agree and disagree respectively this shows that research occupies a big part in smart classrooms, followed by writing activities represented by 82%,18% agree and disagree respectively and in writing activities the study includes preparation of assignment, lesson plan preparation, reading activity also is done at percentage of 78% while 22% disagree the statement, practical demonstration is also done where 72% agreed while 28% disagreed and lastly the researcher identified problem solving activities where 68% agreed while 34% disagreed. Based on the results shown the researcher concludes that in smart classrooms different activities are being done and this leads to integration of ICT in education that help students and Rwandan teachers to transform world.

4.3.2.2 Reasons about teaching using smart devices as more perfect than old teaching technic

All participant in the research agreed that teaching using smart classroom is more perfect than old teaching technic with different arguments like learning of today is not limited to one teacher and single resource but beyond that, thus Smart classrooms create interactive learning, since facilitate the collaboration between students and teachers worldwide. Furthermore, it provides additional materials, video, assessment, animations, and other materials to support the learning. This gives a broader opportunity to students to learn new things with a better understanding and interaction with teachers and the students. EBooks from e learning platform created by REB allows students and teachers to have access to several books, therefore smart classrooms expand learning opportunity to students, Driver like google Apps allow the students and teacher to share the documents the documents online and make change in real time on a screen.

4.3.2.3 Types of learning activities through frequentation of smart classroom

Figure 9: types of learning activities used to achieve learning objectives through frequentation of smart classroom



Source: Primary data 2021

Based on the results presented in bar chart above 4.8 the study found that in order to achieve learning objectives by using smart classroom different activities are being done where the researcher can talk about searching and learning materials and preparation of lesson notes where this activity Is being done daily at a percentage of 53%,the activity that is being done mostly weekly is create materials for students(handouts ,text),the activity that appears at a highest percentage monthly is online professional learning at a percentage of 23%,and lastly the researcher have post information to website to assist students learning at a percentage of 36%.by this the researcher find that some activities are being done daily ,weekly, monthly, but are being done at different percentages but what is seen and observed some activities such as create materials for students, searching for learning and teaching materials and lesson notes preparation are more done daily and weekly while others are being monthly like online professional sessions and practical demonstration

4.3.2.4 Other types of learning activities suggested by to be used in smart classroom

Table 13:Other types of learning activities proposed to be used in S.C

Types of learning activities suggested	**Frequency**	**Percent**
Learning from expert teachers and students/ collaboration with others	41	17.2%
Uploading the lessons	4	1.7%
Power point presentation by using projector	27	11.3%
Listening activities	32	13.4%
Chatting	2	0.8%
Critical thinking	2	0.8%
Relaxing/ leisure (Music activities), observing festival award, World Football program	22	9.2%
Taking note and summary	3	1.3%
Trading news	6	2.5%
Drawing activities	8	3.4%
Computer skills learning / Typing	19	8.0
Speaking activities	14	5.9
Teaching all subjects using S.C not only ICT course	13	5.5
Doing group work / Group discussion in the S.C	22	9.24
Application for school and scholarship	2	0.8%
learning other courses that are not related to the combination	2	0.8%
Online test / E- learning	21	8.8%

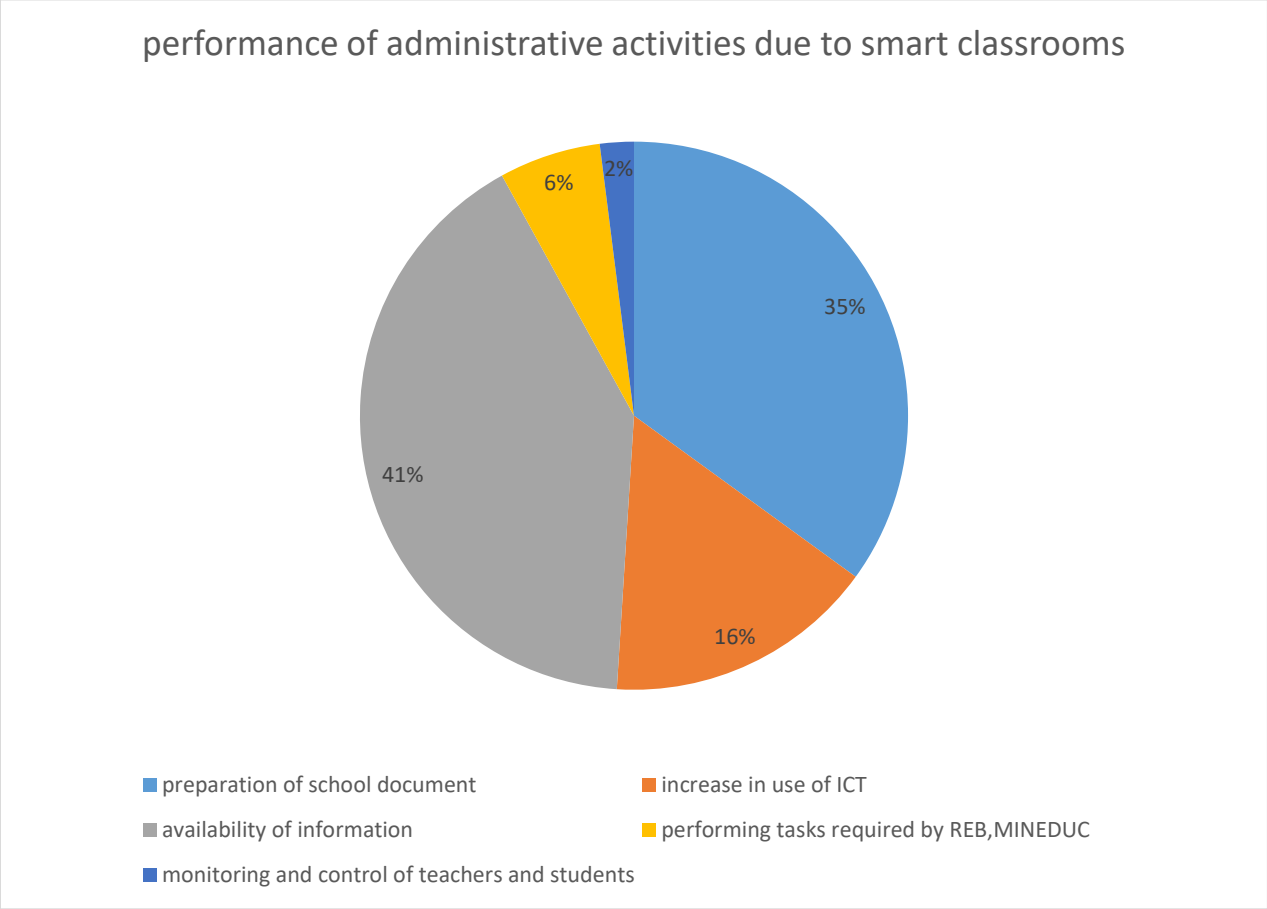
Source: Primary data 2021

Apart from the learning activities that are being used in smart classroom the researcher also mentions others which seems to be important such as learning from expert teachers and students/ collaboration with others / lesson video 17.2%, uploading the lessons 1.7%, power point presentation by using projector 11.3%, Listening activities 13.4%, chatting 0.8%, Critical thinking 0.8%, relaxing/ leisure (Music activities), observing festival award, world football program 9.2% ,taking note and summary1.3%, trading news 2.5%, drawing activities 3.4%, computer skills learning / Typing 8.0%, Speaking activities5.9%, Teaching all subjects using S.C not only ICT course5.5%, doing group work / group discussion in the S.C 9.24%, application for school and scholarship 0.8%, learning other courses that are not related to the combination 0.8%,

online test / e- learning 0.8% and with this, the researcher find that learning from expert teachers and students / collaboration with others / lesson video occupies the first among other learning activity that may be used in smart classrooms.

4.3.2.5 Facilitation of smart classroom in performance of administrative activities

Figure 10: types of learning activities used to achieve learning objectives through frequentation of smart classroom



Source: Primary data2021

According to the results presented in the figure above 4.9 the researcher found that smart classrooms are not used in teaching only it helps also in administrative tasks such as in availability of information at a percentage of 41%, followed by preparation of school documents at a percentage of 35%for instance time, teaching aid, documentation , making presentation during the meeting, filling school reports/ keep the date, Easily and quickly Reporting / preparation of school report , Record of students' marks under software and other relevant data as well as report , Help in planning and making easily school budget, facilitate lesson preparation, Request for capitation

grant, increase in use of ICT at a percentage of 16%,performing tasks required by REB,MINEDUC ,and lastly the researcher performed monitoring and control of teachers and students.

4.3.2.6 Devices in smart classroom

Table 14:Devices in smart classroom

Devices	**available**	**Not available**	**Enough**	**Not enough**	**Strong**	**weak**
Laptops	20	0	15	5	0	0
Smart board	8	12	3	5	0	0
Projector	10	10	4	6	0	0
Internet connectivity	19	1	0	0	13	7
Sound system	4	15	1	4	0	0

Source: Primary data 2021

Based on results in the table above 4.7 the study found that in secondary school there are different technological devices that used in smart classrooms such as computers, smart board, projectors, internet connectivity, sound system and where in many smart classrooms computers are available than other devices.

4.3.2.7 Types of technology resources available and used at school

Table 15:Technology resources available and used at school

Devices	**Availability**		**If it has been used**		**If it was accessible**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Computer for teachers	77%	23%	73%	27%	70%	30%
Computers for students	100%	0%	85%	15%	67%	33%
Smart board	59%	41%	37%	63%	37%	63%
Projector	89%	11%	71%	29%	70%	30%
Internet connectivity	97%	3%	90%	10%	86%	14%
Printer	87%	13%	79%	21%	70%	30%

Source: primary data 2021

Based on the information in the table 4.8. the study found that different devices such as computers for teachers are available at a percentage of 77%, computers for students are available at a percentage of 100%, smart board 59%, projector at a percentage of 89%, internet connectivity at a rate 97%, printer at a percentage of 87%. computers for teachers, computers for students, projector, internet connectivity, printer are represented 73%,85%,71%,90%,79% respectively while on another hand there is a big part of them who said that even if smart board are available but are not used at a percentage of 63% while they say that are being used at a percentage of 37% so the researcher have to encourage teachers to use them, the same case for accessibility of those materials where computers for teachers, computers for students, projector, internet connectivity and printers are accessible at a percentage of 70%,67%,70%,86%,70% while smart board are accessible at a percentage of 37% ,not accessible at a percentage of 63% this indicate that most technological devices are available used and accessible by teachers and students except smart board which is not used and accessible at a highest percentage.

4.3.3 Possible challenges regarding smart classrooms utilisation and related mitigating strategies

4.3.3.1. Challenges in the use of smart classroom.

Table 16:Table of challenges in use of smart classroom proposed by teachers

Challenges	**Agree**	**Disagree**
Inefficient time to prepare lessons and materials based on technology	71%	29%
Inefficiency of teachers' technical knowledge to prepare materials based on technology	59%	41%
Problems about accessibility to computers	49%	51%
Problems about accessibility to internet	47%	53%
Shortage of computers (insufficiency of computers to cater for all students at once	68%	31%
Inefficiency of guidance and support by administration	39%	61%
Lack of interest of teachers in technology usage	33%	67%
Threat of theft of computers lead to poor utilization of smart classrooms as a way of protecting computer from thieves	39%	61%

Source: Primary data 2021

Based on the result presented in the table above 4.9 that shows different challenges in use of smart classroom the researcher observed that 71% agreed that inefficiency time to prepare lessons and materials based on technology is coming at first position while 29% disagreed on the same statement. This was also confirmed during interview with respondents where one said: "*The first challenge is insufficient time allocated to teachers due to the heavy workload they have and insufficient smart classrooms. They say that teachers must have more time in Smart classroom to deliver a quality course, despite the limited number of computers comparatively to the number of students in schools. Additionally, some students are not familiar with the use of computers due to their background. Many students do not manage the rapidity on the keyboard, even though they are interested in knowing computers despite the low opportunity to use them. They also raised the issues of damaged computers that are not timely repaired due to the process of repairing them"*

The inefficiency of teachers with technical knowledge and skills to prepare materials based on technology occupies 59% while 41% disagreed. The shortage of computers also seems like a challenge in using smart classroom where even if 68% agreed but contrary 31% disagreed. It was clarified by one respondent who declared that "*Smart classrooms are not enough to serve all students appropriately. If they were enough, we would organize more teaching sessions in the Smart classrooms. Ideally, one period per subject per a week is not enough. Another issues they pointed out is teachers' knowledge about smart classrooms equipment: some teachers are not familiar with computers, there is a need of training for teachers so that they could be able to use a wide variety of instructional materials sufficiently well'*. The problem about accessibility of computers has raised because computers are kept by the school and sometimes head-teachers may refuse to give computers to teachers when they are in need, and this has been focused on a percentage of 49% who agreed and 51 % who disagreed. To complement with the inappropriate use of computers, one respondent explained that "*there is a misuse of computers and internet connectivity during work hours. some teachers used to be found listening to music, downloading music, and visiting cybersex at work. Also, some students get disturbed by inappropriate websites due to their age. Additionally, there is an issue of poor internet connectivity and lack of support teachers able to handle all technical issues that used to occur in the Smart classrooms". Also, some head teachers prefer to let computer in the store due to the fear of tough punishment they get when they lost computer and other technological tools.*

Problem about accessibility to internet is represented by 47% who agreed and 53% who disagreed, inefficiency of guidance and support by administration has been agreed 39%, while 61% disagreed,

lack of interest of teachers in technology usage 33% who agreed while 67% disagreed, lastly threat of theft of computers lead to poor utilization of smart classroom as a way of protecting computers from thieves where 39% agreed and 61% disagreed.

4.3.3.2 Factors that slow down the efficiency of exploitation of smart classroom

Table 17:Table of challenges in use of smart classroom

Factors that slow down efficiency exploitation of S.C	**Frequency**	**Percentage**
Insufficient technological devices	421	70%
Unskilled teachers	95	16%
Unskilled students	44	7%
Poor plan of using S.C	33	6%
Short time for using S.C	6	1%

Source: Primary data 2021

Based on the results presented in the table above 4.10 that shows different factors that slow down efficiency exploitation of smart classrooms the researcher found that the one that comes at the first position is the insufficiency of technological devices which occupies 70% and among those technological devices the researcher noted the availability of computers, smart board, sound system, internet connectivity tools and this means that it becomes difficult for teachers and students to use smart classroom in a good way due to insufficiency of those devices, unskilled teachers that represents 16% some teachers are not trained on how to use ICT in education in general particular it seems difficult for them to know how to use smart classrooms, unskilled students some students don't have basic knowledge on how to use a computers and other different technological devices which can help them in learning process into a smart classroom, poor plan of using smart classroom that represents 6% this is due to many classes in secondary schools while they are one or two smart classroom and also in some schools this smart classroom is used as computer room used by teachers of ICT, short time of using smart classroom that occupies 1% this is due to the curriculum that do not involve usage of smart classroom in lessons. Briefly they are different factors that may slow down efficiency of using smart classroom in secondary school.

4.3.3.3. Suggested solutions to overcome non-exploitation of smart classroom

Table 18: Suggested solution for overcoming non-exploitation of S.C efficiently

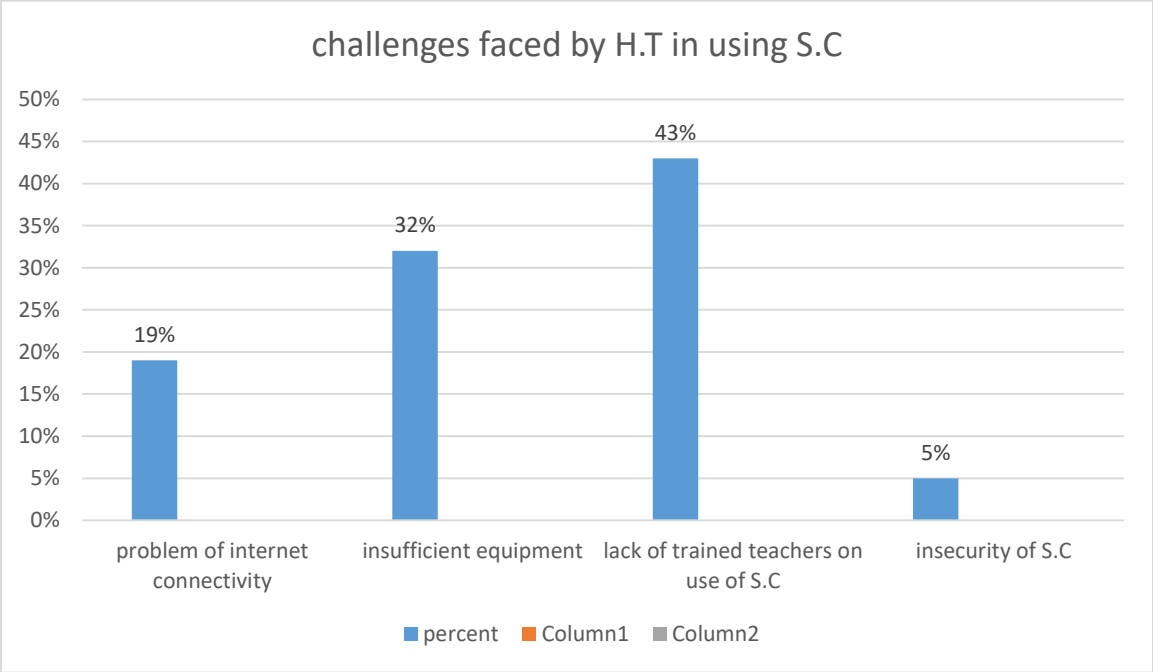
Solutions	**Frequency**	**Percentage**
Increasing technological devices	50	71%
Training for teachers	5	7%
Motivation to learners	6	9%
Increase time for S.C	9	13%

Source:primary data 2021

As said above in the tablee 4.10 of views from students and teachers ,the figure 4.10 shows the views of head teachers on the challenges faced in efficiency exploitation of smart classroom where they said that 43% find that smart classrooms is not exploited due to lack of trained teachers on use of smart classroom because they say that smart classroom Is availabale but they don't use it properly,followed by insufficient equipement at a a percentage of 32% in this the researcher mentions insufficient computers,projectors,no sound system,intenet connectivity also is a big problem that lead to unexploitation of smart classroom in secondary school at a percentage of 19% this is observed in slow internet connectivity and sometimes it goes totally,lastly there is a problem of insecurity that represents 5% where it is a burden for headteachers to pay the guardian who will stay at smart classroom,due to fear that computers may be stolen they prefer to keep them in store lather than to give them to the learners for more practices.briefly once these challenges are solved in the vision of headteachers smart classroom may be exploited efficiency.

4.3.3.4 challenges faced when using smart classroom in the views of head teachers

Figure 11: challenges faced when using smart classroom in the views of Head teacher



Source:primary data 2021

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4.3.3.5 Proposed solutions in the views of head teachers

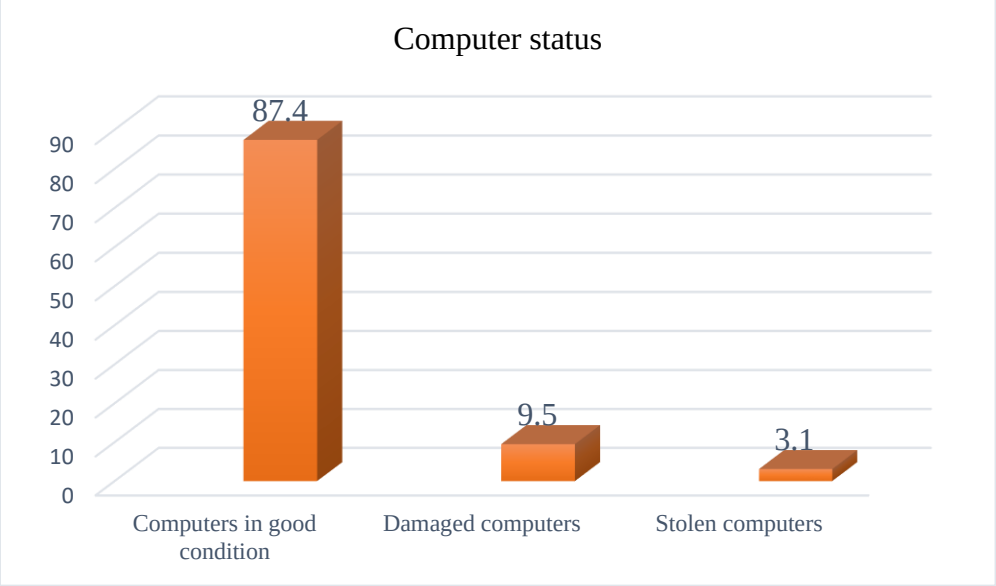
Table 19:Proposed solution to overcome challenges in using S.C

Proposed solutions	**Frequency**	**Percent**
Reduce teachers' workload to give them enough time for preparation and arranging smart classroom	8	26%
Provide a well (strong) internet connectivity	4	13%
Provide necessary and sufficient devices and repair them on time.	11	36%
Training of teachers who use S.C	9	29%
Helps school to get security(security camera)	1	3%
Recruit teacher for S.C only (S.C Assistant) able to help others and prepare courses	6	19%

Based on the finding in the table above 4.12 head teachers have suggested the solutions to overcome listed challenges mentioned in the figure 4.11, provide necessary and enough equipement at a percentage of 39%,followed by training teachers on use of ICT and use of smart classroom at a percentage of 29%,followed by providing teachers who are in smart classroom for maintainance ,and help learners who come in smart classroom this is represented by 19%,internet connectivity at a percentage of 13% and lastly help school to have security for example they may establish security camera and pay security guard.

4.3.3.6 Status of computers provided to schools for smart classroom purpose

Figure 12:Status of computers in smart classrooms.



The result from the figure above shows that, Rwanda basic Education Board (REB) has distributed 3,129 computers in schools, however only 87.4% are in good condition wich is equivalent to 2,732 of computers that can easly help teachers to teach and students to learn. 9.5% are damaged and need to be repaired, this percentage is equivalent to 300 damaged computers, which is bringing access contraint for the reason of inadequate computers which can lead in return to the failure of educational technology. In the same vein, 3.1% of computers have been stolen which is equivalent to 92 computers. In the same view, the theft of ICT equipment is a big challenge with direct effects on the use of technological devices that are available in smart classroom, school administrator does not make available some ICT equipment due to being afraid of having stolen and become untrusted by their managers.

4.4 Discussion of the Findings

This study was guided by three specific objectives namely:

i. To assess the teachers and students' perceptions towards smart classrooms in secondary schools

ii. To find out possible challenges regarding smart classrooms utilisation and related mitigating strategies

iii. To find out teaching and learning activities that teachers perform in the Smart classrooms.

The discussion was done by confronting the study results from respondents to the existing theoretical and empirical literature. It was done in the order of specific objectives.

4.4.1. Teachers and students' perceptions towards smart classrooms in secondary schools

4.4.1.1: Perceptions of students

Based on the findings highlighted above students appreciated the establishment of Smart classrooms in Rwanda. 98% of the respondents confirmed their motivation when teaching and learning process is conducted in the smart classroom. They highlighted that smart classroom helped to improve readings, writings, problem solving, sharing experiences with others as well as learning from others, and storing notes to be accessed when needed. In a nutshell they recognized the suitability of smart classrooms in making lesson more interesting.

For the improvement of reading and writing skills students said that, through digital literacy and practising oral fluency, reading, and writing skills get improved. In addition, students who have trouble with spelling and grammar, organizing and arranging their thoughts use computer for help. The interviewed students argued that "Smart classrooms help us to have knowledge on vocabulary and the meaning of the words in the texts we read. When we read article online or when we are watching a movie with English subtitles, we get the meaning of unknown words in online dictionaries, therefore we learn many words from the web".

These findings are supported by Yunus, et al., (2013) who stated that watching captioned movie clips on vocabulary development of learners and this would ease reading process. On the other hand, Bakeer, (2018) argued that Smart classroom motivate students to be creative and learn in an

enjoyable environment, they can easily write their essays anytime because they can find a lot of information related to any topic on the web.

As highlighted by the students, smart classroom contributes to problem solving hence it helps students to monitor and accomplish their own work. when students face with difficult problems, they make their own research and they come up with the real solution, without consulting their teachers since teachers are no longer the main source of information when technology is well used. In the smart classrooms, students get encouraged to investigate, try to find the truth, develop ideas, and solve the problem.

The finding is supported by the idea of Future lab (2009) who reported that learners take ownership/ cooperative learning and problem solving when it is done in the smart classroom. He added that a variety of sources get available for free when using smart classroom. Also, Jena, (2013), stated that Smart classrooms increase the depth of students' conceptual understanding by breaking down learning goals into controllable section at the same time collaborative learning can be implemented.

For the sharing experiences and learning from others, students said that they collect knowledge through video uploaded by expert teachers and students. They access information in collaboration with others. This implies that smart classroom facilitates collaborative learning. The idea was supported by Sevindik, T. (2009) who stated that through smart classroom the interaction and collaboration of students occurs at high level. In this configuration, the outcome of collaboration was described as data sharing, authority sharing and collaboration between the classroom environment and mixed group.

As highlighted in findings students have positive perceptions toward smart classroom, most of them confirm that they are more interested to take lesson in smart the classroom hence data are more visual and clearer, the lesson is more pleasurable, and it is not boring but amazing environment.

4.4.1.2 Perceptions of teachers

With this smart classroom, teachers must use this opportunity by encouraging students to be active and participate in the course that may lead to superior performance of the students that lead to increase in their knowledge. Those findings match with Mbonyinshuti (2018) who wrote that making available smart classroom in different schools is essential in education area where public

and government aided schools will be connected by 2020. The goal of the smart classroom is to integrate technology into various aspects of the country's education system and revolutionize the learning and teaching system. UNESCO (2019) also asserted that the education sector in Rwanda is growing through adoption of information and communication technology (ICT). Where was the focus before on the massive deployment of portable devices, it is progress towards child-centered adaptation progress learn and use an ICT-enhanced environment to enrich teaching and learning.

As it was found, there are many factors that influenced head teachers to have smart classroom and among them respondents listed the use of Microsoft word, excel, and power point to present information to students, promote research and self-coaching among students, professional development opportunities at school, administrative influence, parents, and students influence, availability of smart classroom in neighbouring schools, helping teachers to prepare teaching documents. Most of the head teachers decided to come with a smart classroom to help teacher prepare teaching documents, due to influence of students and parents who are complaining it to support students 'engagement with collaborative learning, using it in order to present information to students by using Microsoft word, excel, and power point presentation. ICT are increasingly important in our daily lives and in our education system. Consequently, he is a growing demand from educational institutions to use ICT to learn skills and knowledge students need the 21st century. Understanding the effect of ICT on the workplace and daily life today's educational institutions are trying to restructure their curricula and classrooms facilities, to bridge the existing technological gap in teaching and learning. it the restructuring process requires the effective adoption of technologies in the existing environment to provide students with knowledge in specific areas, to promote learning and improving professional productivity (Tomei, 2005).

Respondents stressed on the fact that the core business of the school is to promote effective teaching and learning, each school mission and vision turn around the improvement of quality of education, thus introduction of smart classroom in the school is one of the strategies aimed at improving teaching and learning process which is an important point of school vision and mission. According to them, students are being equipped with the skills helping them to learn outside the classrooms, peer learning is being promoted hence students are collaborating with others through different platforms, they are getting different resources from their colleagues of the other schools, additionally smart classroom is a significant motivational factor in the students, once the computers arrived in the school students became active and participative. On the side of teachers,

smart classrooms allowed them to have access to most up to date teaching content through various research they are making on the websites and platforms. Furthermore, it is making easier planning and preparation of lessons and sharing resources. To this end, deputy head teachers in charge of studies have positive perceptions toward smart classrooms since they have already recognized the importance of Smart classroom in their schools.

Also, the study revealed that it is good to encourage both teachers and students to use smart classroom. the researcher insisted on reducing teachers' workload to get enough time for preparing and developing lesson that will be provided to students in smart classroom. Furthermore, students need to have enough time for using smart classroom. This has been taken as important at the percentage of 84%. The above finding is linked with the idea of Kaur (2018) who asserted that the education plays a crucial role in improving standard of living, progress, innovation in current years. Schools and other educational institutions have started adopting modern teaching methods through smart interactive whiteboards, smart projectors, and notebooks, etc. There is no denying it, due to the improvement in technology, students decide to use tablets, phones, and other devices to share and transfer study material which saves them time and effort. On the flip side, this smart classroom helped teachers to be engaged in lesson and this facilitate sharing information and better presentation online without having to write by hand.

Based on the results found on the first objective, both teachers and students appreciated the introduction of smart classrooms in Rwandan education system, therefore, they are very motivated towards teaching and learning process when take place in smart classroom.

4.4.2. Teaching and learning activities done by teachers in the smart classrooms.

Based on the results about the activities related to teaching done by teachers in the smart classrooms, it was found that there are different types of learning activities done in smart classrooms like reading and doing research occupy a big part in smart classrooms. But writing activities were also mentioned by respondents. They assumed that smart classrooms allow preparation of assignment and lesson plan preparation, and practical demonstration is also permitted. IvyPanda (2019) clarified that smart classrooms are technological advancements used in educational institutions. This requires the use of an instructor station consisting of a computer and some audiovisual equipment that allows the instructor / teacher to facilitate learning using various media. Smart classroom technology promotes teaching and learning.

All participants in the research agreed that teaching using smart classroom is more perfect than traditional teaching methods with different arguments like earning of today is not limited to one teacher and single resource but beyond that, thus Smart classrooms create interactive learning, since facilitate the collaboration between students and teachers worldwide. Furthermore, it provides additional materials, video, assessment, animations, and other materials to support the learning. This gives a broader opportunity to students to learn new things with a better understanding and interaction with teachers and the students. eBooks from e learning platform created by REB allows students and teachers to have access to several books, therefore smart classrooms expand learning opportunity to students, Driver like google Apps allow the students and teacher to share the documents the documents online and make change in real time on a screen.

The study also found that to achieve learning objectives by using smart classroom different activities are being done where the researcher can talk about searching and learning materials and preparation of lesson notes for an effective education. ANU_V (2021) asserted that quality education is vital in today's world. As the world changes rapidly and competition increases, so must you. In other words, beautiful classes are a technical advantage for an education system. It gives students the opportunity to help understand positive thinking and achieve academic achievement. The education sector has seen tremendous growth in recent years. Schools and institutions have begun to adapt to modern teaching methods using technology. We cannot ignore the fact that this technology has made learning interactive and easy. The technology, however, is bound to change one's purview, when these blackboard classes are being transformed to 'Smart Classes'.

4.4.3. Challenges regarding smart classrooms utilisation and related mitigating strategies

4.4.3.1: Challenges highlighted by the respondents

The first challenges raised by teachers is shortage of time to prepare lessons and materials based on technology. This was due to heavy workload they have and insufficient smart classrooms. They say that teachers must have more time in Smart classroom to deliver a quality course, despite the limited number of computers comparatively to the number of students in schools. This view is supported by the idea of Pelgrum, W. J. (2001) who found that, the obstacles that educationist perceived as the impediments for achieving their schools-based ICT objectives are in two conditions namely material along with non-material. For the material condition, he found the insufficiency of ICT devices whereas for non-material condition is insufficient time for teachers

and lack of knowledge among teachers as well as students. According to Mulambe, S.O (2017) the overloaded teaching timetable can discourage the integration of technology in teaching practice since it does not release time for preparing lessons and searching relevant information to use in teaching. In the similarity with the findings of Chowdhury (2018), many teachers do not complete information in the slide because they do not have time to revamp teaching learning components in accordance with technology.

The second challenge is misuse of computers and internet connectivity and smart classroom in general. In this view researcher found that during work hours some teachers used to be found listening to music, downloading music, also, some students get disturbed by inappropriate websites due to their age. The problem about the accessibility of computers and misuse of smart classroom facilities has been raised because most of the time, computers are kept by the school administrators and refuse to give computers to teachers when they are in need. These findings are in accordance with Siddiquah, et al., (2017), who stated that some teachers and students spend more time on computers for entertaining and other purposes rather than the academic objective. Additionally, De Dieu Mushimiyimana, J. (2021) found that a lot of computers stay in store at school, any teacher is allowed to go in the smart classroom and use them regularly in teaching.

The third challenge is the low level of using computer among students. Researcher found that some students are not familiar with the use of computers due to their background. Many students do not manage the rapidity on the keyboard, even though they are interested in knowing computers despite the low opportunity to use them. It is in line with Dincer, S. (2012) who highlighted that student from rural area are not competent enough on using computers, he concluded saying that for better using appropriately smart classroom, students and teachers must have enough competency on computer usage so that students can be able to use computers and search for information on their own.

The problem related to the insufficiency number of computers has been raised, since each secondary school is equipped with one hundred computers in two rooms. Therefore, the statement above, has been analysed in terms of Smart classroom ration whereby in the big schools, one smart classroom is used by nine classes whereas in the small schools, it is used by three classes. From this idea Smart classrooms are not enough to serve all students appropriately. Teachers cannot organize more teaching sessions in the smart classroom due to its insufficiency. To this end, most of teachers utilize smart classroom once a week. This was also found by by Odera, (2011), who

expressed that inadequate supply of computers in most of secondary schools is one of the major problems attributed to poor implementation of computer education in Nigeria.

The fourth barrier is related to teachers' knowledge about smart classrooms equipment. The researcher found that some teachers are not familiar with computers due to their background. Some students are more expert than teachers. To this end, lack of experience and proficiency on the side of schoolteachers who are computer illiterate, in opposition to today's students who are quick to self-educate and extremely computer literate is a big problem that can decrease teachers' confidence and lead to poor utilization of smart classroom. Therefore, there is a need of training for teachers so that they could be able to use a wide variety of instructional materials sufficiently well. This finding is associated with the, Pelgrum, W. J. (2001) results who reported that the lack of teachers' knowledge and skills related to ICT, is one of the obstacles led to poor integration of ICT in education. In this regard, the lack of a well-trained teachers and low levels of technology skills and knowledge of teachers has been considered as a major obstacle in the execution of ICT in schools.

The fifth challenge highlighted is hard punishment to the head teachers when they lost computers and other electronic devices. Consequently, some head teachers refuse to take on those risks and prefer to let those materials in store due to the fear of tough punishment they get when they lost computer and other technological tools. To this end, school leaders make restricted conditions that do not encourage teachers and students to use smart classroom, and it led to poor utilization of smart classroom. This idea is supported by Mugiraneza (2021) who stated that the theft of ICT equipment is a big challenge with direct effects on the use of technological devices that are available in smart classroom, school administrator does not make available some ICT equipment due to being afraid of having stolen and become untrusted by their managers consequently.

The sixth challenge emphasized, is poor internet connectivity: as it is observed by the researcher internet connectivity is available in each school with Smart classrooms but on slow level. Therefore, it takes too much time in loading document when students want to make a research or other school activities that involves the presence of internet connectivity. This embeds the high quality of learning opportunity among students.

The seventh challenge is the issues of damaged computers that are not timely repaired due to the process of repairing them. The issue of undamaged computers has been raised in this research. They said that when computer is damaged it take a long process to be repaired, only REB has the

mandate of repairing computer. They suggested to allocate support staff in charge of computer maintenance hence computers provided to schools are not in good quality they easily damaged, therefore, the person who can fix all technical issues that used to be occurred on computers is highly needed in each school. The computers in good condition motivate teachers to bring students to the smart classroom.

The Rwanda Basic Education Board (REB) has started with the establishment of 500 smart classrooms crosswise the country and they are expected to be operational at the maximum, which will essentially pave the way for the expansion of the program. According to REB, 9 percent or 531 schools in Rwanda currently have Internet access; but the partnership with Microsoft was expected to help provide access to more than three million students and 61,000 teachers in the country's 3,500 schools by 2020. Although smart classrooms have more benefits, The Times Reporter (2017) noted that there are a few challenges with the new system: internet connectivity issues which is too slow and a lack of computers to serve all students at the same time.

All primary and secondary schools in Rwanda are expected to adopt technology in teaching and learning by 2020 as part of a government effort to digitize the education sector. The project partnered with Microsoft Corporation, as mentioned earlier, is expected to reduce the cost of delivering the curriculum and learning materials to schools and improve learning outcomes. However, three years after the plan was introduced, the government still has not reached its target. Currently, the absorption of information and communication technologies (ICT) in the education sector is 64 percent and 55 percent respectively in primary and secondary schools, according to the Ministry of Education. Limited access to electricity prevents some schools from adopting ICTs in education, according to Samuel Murindwa, permanent secretary of the Ministry of Education. In fact, the government allows all public schools and public assistance schools to have smart classrooms. However, access to electricity is one of the limiting factors for the deployment of smart classes (Bizimungu, 2020).

4.4.3.2: Strategies related to better use of smart classroom

The respondets have suggested the solutions to overcome the highlited challenges such as:

Reduce teachers' workload for getting enough time to prepare materials and exploit fully smart classroom. Smart classroom to be utilized successfully require enough time for teachers to prepare lessons-based technology, making research, prepare students' work, downloading documents, etc.

in addition, students proposed to increase time allocated to smart classroom usage so that they can exploit smart classroom at the maximum. This requires plentiful time for teachers to guide and coach students while frequenting smart classroom. As it is found by Alharbi, (2013) in his research, the barrier that teachers face every day of their teaching can discourage them or reduce their will to implement technology is time. From his view, most of teachers seem to lack the time needed to learn and apply to use technology in their daily activities.

For the challenges related to misuse of computers and internet connectivity, the respondents proposed to block distractive websites for better learning. They also suggested to make a timetable for all classes to use the smart classroom that is available for the whole schools so that all students and teachers may have the same opportunities of using smart classroom in due time. They also added that teachers must understand the benefits of smart classroom in promoting digital learning. Therefore, they must have sense of urgency if not measures related to the punishment of teachers and students who used to be found in smart classroom listening to music and exploring prohibited websites must be in place. It is in line with the idea of Al-Abdullatif et al., (2020) who suggested to punish students who misuse internet and other educational technology devices. Likewise, to Vosburg, (2017), who proposed to establish web monitoring program allowing to block individual addresses access as well as group of websites. The program allows to set up the content blocks for access level.

Additionally, the respondents proposed to let students exploit smart classroom at any time they feel free. According to Johnson et.al., (2016), no single educational technology is perfect for every teacher and student, therefore teachers and students should select and adopt strategies that they feel most comfortable with. From this point of view, giving students more freedom of using smart classroom especially in weekends time will enhance students' ability and interests of using smart classroom.

For the issue of not having smart classroom experience that leads to insufficient knowledge about smart classrooms activities, respondents said that there is a necessitate to emphasis on pedagogical training of teachers and school leaders with accent on the way that technology can support collaborative teaching and learning. They highlighted that few trainings have been given to some teachers but not directly touch to the integration of smart classroom in teaching. To this end, short of continuous opportunity for teachers to take on new technology and suitable coaching, leads to poor utilization of Smart Classroom. In this concept training and support is key for the success of smart classroom utilization and the eventual success of the students taught in such learning area.

(Skipton et al., 2006). Organize more trainings for teachers to get used and practice with digital devices successfully. It is in the context of Jena et.al., (2013), who suggested that there is to emphasis on pedagogical training of teachers on the way that technology can support collaborative learning and teaching and how it can be fully integrated in education.

For the issue related to the inefficiency number of computers in smart classrooms, the respondents suggested to construct smart classroom to give students and teachers more opportunities to integrate smart classroom practices in different teaching subjects and different levels of students. Furthermore, the provision of necessary and enough equipements has been raised by the respondents. It is in the same view with Jena et.al., (2013), who stated that the accessibility to the technology should be extended to all teachers and students by adding smart classroom to each school with enough digital equipment.

For the issue related to the theft of computers that lead to poor utilization of smart classrooms as a way of protecting computer from thieves, the respondents proposed to install security camera to protect computers and other ICT devices from thieves and also to reformulate the instructions related to the management of computers so that a head teacher who miss computer will not be punished anyhow. They said that when computers missed, they get tough punishment like requesting head teachers to replace the stolen computers on their own, being imprisoned and sometimes being suspended from the job. This is supported by Mugiraneza (2021) who reported that deep investigation should be conducted before applying hard punishment to head teachers who miss computers and other devices in the smart classroom.

For the issue of repairing computer on time the respondents proposed to decentralize the process of maintaining computers to schools' level by recruiting a staff able to repair the damaged computers and allocating maintenance budget to schools. This idea is reinforced by Tu'ifua-Kautoke et.al., (2015) who found that consistent maintenance of computers and other devices is essential to ensure that they are always in working condition.

CHAPTER FIVE: SUMARY, CONCLUSION AND RECOMMENDATIONS

5.0. Introduction

This chapter contains the summary of the findings, conclusion drawn from the study, recommendations and suggestions for the further research . As the introduction of Competence based curriculum in Rwandan schools demands for a change and new thinkings about instructional stategies in teaching , learning and assessment processes. The integration of technology in education is seen as a strategic way for achiving this transformation. Thus, the investment in setting up smarct classrooms influence significantly learning and teaching process as well as students achievement.

5.1. Summary of the findings

The purpose of this study was to describe**,** analyse and interpret teachers and students' perception on the use of smart Classrooms in secondary schools.

Briefly it has seen that based on the results in the findings the researcher found that respondents participated in the research are coming from 20 schools that have smart classrooms where 20 head teachers have been involved in the research,150 teachers both male and female have filled the questionnaire, 20 teachers provided their view through Group discussion strategy. 393 students from different classes were selected from senior one up to senior six in secondary schools' general education and students from TVET have been selected from different levels of study. Additionally, demographic characteristics, marital status, age, gender, and education level even classes for students were taken into consideration.

On the first objective on perceptions towards smart classrooms in secondary schools, the findings revealed that smart classroom is important in daily instructions because students are highly motivated when the teaching and learning activities take place in the smart classrooms as 99% of students agreed. Students also agreed that Smart classrooms help in doing research aimed at enriching resources given to the students. Deputy head-teachers said that Smart classroom is in mission and vision of the school; hence it is used weekly in different classes for promoting teaching and learning. They added that it helps students to have knowledge about the subject by having many materials. To this end, the use of technological devices in teaching has the potential of making students understand the content easier as they get diverse perspective.

Research also revealed that teachers frequent smart classroom due to different reasons such as Developing lesson plan and other relevant documents, learning from expert teachers the updated

pedagogical skills, prepare different activities (assignments) to be provided to students. However different factors can encourage teachers to effectively use smart classroom such as reducing work load to provide opportunities to teachers for developing instructional materials, Investment on in-service education programs for instructional technologies, increase number of smart classrooms, Equip the whole school with the internet connectivity, Carrying out the studies for integration of technology into curriculum, Prepare model lessons in which technology is included, Rewarding the efforts of teachers towards the use of smart classrooms. Furthermore, the use of smart classrooms makes learning more effective, increase the interested of the students and they become more active and participative. It also plays a role in searching various information related to teaching, increasing quality of courses. Additionally, using smart classroom helps to make easy to prepare course materials (assignment, handouts) and finally smart classroom help to handle different learning preferences of students having different learning styles, helps to ease teaching activities and help in management of time, help to get good answer and satisfactory answers.

On the second objective about challenges faced during the use of smart classroom in their respective schools, respondents identified the insufficiency of technological devices namely computers, smart board, sound system, internet connectivity tools, unskilled teachers in the use of ICT in education, poor plan of using smart classroom due to many classes in secondary schools while there is one or two smart classrooms and also in some schools this smart classroom is used as computer room used by teachers of ICT, short time of using smart classroom due to the curriculum that do not involve usage of smart classroom in lessons.

They hence have proposed different measures to be taken for efficiency exploitation of smart classroom like increasing technological devices such as computers ,repair computers on time, increase number of projectors ,sound system,smart board and proving strong internet devices able to serve appropriately a smart classrom. They proposed also to increase number of hours to last into smart classroom,training students on the proper use of smart classrooms because some students tend to immerse in themeselves in serching for needless information.Motivation of learners must also be taken into consideration because when learners are not motivated they do not utilise smart classrooms that is why also the teachers should get training on properexploitation of smart classrooms. Briefly in case all those focused points are taken into consideration both teachers and learners will exploit efficiently smart classrooms.

For the last objective in regard to teaching and lerning activities through smart classroom, it was revealed that making a research come at the first position then writing and reading activities at the

second place, practical demonstration and problem solving at the third place. In addition, teaching by using smart classroom is better than using traditional method was said by dean of studies with different arguments such as Learning of today is not limited to one teacher and single resource but beyond that, thus Smart classrooms create interactive learning, since it facilitates the collaboration between students and teachers worldwide,

According to the findings smart classroom also help in different administrative tasks such as easily availing the information, preparation of school documents, preparing timetable, teaching aids, documentation, making presentation during the meeting, prepare and filling school reports, easily and quickly reporting, record of students' marks under software and other relevant data as well as report. help in planning and easily making school budget, facilitate lesson preparation, request for capitation grant, performing tasks required by REB, MINEDUC, increase in use of ICT, and finally monitoring and controlling teachers and students

5.2. Recommendations.

The following recommendations are based on the finding:

5.2.1 Recommendation to head teachers

- ✓ Head teachers must elaborate clear guidelines and timetable related to the proper use of smart classrooms to avoid misuse of Smart classrooms for both teachers and students.
- ✓ Head teachers have to free technological devices under Smart classrooms for full utilization of it for both students and teachers.
- ✓ Head teacher should ensure that smart classrooms are well efficiently used within the existing teaching and learning framework to enrich students' classroom experience.
- ✓ Head teachers should organize continuous professional development on the use of Smart Classrooms in teaching and learning process.
- ✓ Smart classroom should not be confused with ICT room conceptionally from the view of effectiveness in the learning and teaching process.

5.2.2 Recommendations to students

- ✓ Students must know that the proper use of resources is what brings positive effect, thus searching for unnecessary information while they are in the smart classrooms can make them fail therefore, and they must productively use it.
- ✓ Students must be active when they enter to the smart classroom
- ✓ Students must make great effort in using technological devices

5.2.3 Recommendations to teachers

- ✓ Teachers must incorporate smart classrooms in their lessons so that students are equipped with competencies and skills they required to. Computers must be used to prepare their lessons in all subjects.
- ✓ Teachers are encouraged to facilitate learners in using smart classrooms in all subjects, this can be done if teacher design a weekly Smart classroom use timetable
- ✓ Teachers should attain the training on using smart classroom

5.2.4 Recommendations to educational institutions

- ✓ Effective professional development for teachers in the integration of smart classroom into instructional is necessary. The Ministry of Education and its agencies must fund a sustained high-quality professional development as well as investment in equipping schools with sufficient computers and strong internet connectivity.
- ✓ Educational institutions should develop a clear guideline regarding the use efficiently few computers in all subjects and to many students.
- ✓ Education institutions should motivate teachers to use smart classroom into the daily learning schedule.
- ✓ School management must be reformulated hence some headteachers blame MINEDUC and REB to give hard punishment to the leaders who miss computers and other technology devices.
- ✓ Smart classroom should be demoted to primary level for integrating technology in that level.

5.2.5 Recommendations to stakeholders

- ✓ Due to the importance of smart classroom in strengthening education and learning process, all sponsors must invest in all vital facilities aiming at supporting the efficient use of this today's technology.

5.3. Suggestions for further research

Future research could focus on the impact of smart classrooms on the students' performance. In that time a researcher will compare the performance of students before the establishment of smart classrooms in schools and after.

5.4 Conclusion

Smart classroom in secondary school is crucial due to its benefit towards teachers, students, and administration and once all concerns provide all requirement smart classroom may be used efficiently**.**

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APPENDICES.

Appendix1: Authorization letter to carry out research from UR College of Education

UNIVERSITY of RWANDA

COLLEGE OF EDUCATION

OFFICE OF THE DEAN

TO WHOM IT MAY CONCERN

Dear Sir/Madam

Re: Mr. Protegene MUHIRE Reg. 219000037

The School of Education offers MEd in Educational Leadership and Management. As part of the academic requirements, students must write their dissertations on the topics of their choice.

In order to facilitate them complete their studies, we seek your cooperation in allowing the above named student conducting his research on the topic: **" Teachers and Students Perceptions on Use of Smart Classrooms in Secondary School. (A Case study of Huye District")** to collect data in your Institution/Organization.

In case you may require any other information regarding this exercise you are welcome to contact the School of Education.

Thank you for your cooperation

Sincerely yours

Done at UR-CE on 19/10/2020

Signed

SCHOOL OF EDUCATION * COLLEGE OF EDUCATION *

Dr. Innocent Twagilimana

Ag. Dean, School of Education

Email: i.twagilimana@ur.ac.rw

Tel :(+250)787684457

EMAIL: school_education.ce@ur.ac.rw P.O. Box: 55 Rwamagana WEBSITE: www.ur.ac.rw

Appendix 2: Authorization letter to carry out research from Huye District

REPUBLIC OF RWANDA

Huye on 05/02/2021
N° 354/02.04

SOUTHERN PROVINCE
HUYE DISTRICT
E-mail : huyedistrict@huye.gov.rw
Ref: Education Unit

Protogene MUHIRE
Master student in Education leadership
and Management / UR-COE

RE: Authorization letter.

Dear Sir,

Reference is made to your letter dated 3rd February 2021 requesting for authorization to collect data on the topic **"Teacher and students' perceptions on the use of Smart Classrooms in Secondary schools". A case study of Huye District;**

Reference is also made to the recommendation letter from UR -College of Education, dated on 19th October 2020 proving that Mr. **Protogene MUHIRE** is a master student in Education Leadership and Management;

I hereby inform you that you are authorized to conduct your research in the sampled schools of Huye District.

Regards,

Ange SEBUTEGE
Mayor of Huye District

Cc:
- Chairperson of Huye District council.

Indatirwabahizi dukorane umurava dutere imbere Page 1

Appendix 3: Guiding questions for students

Dear Sir / Madam.

I' am a student at University of Rwanda- College of Education. I' am making research on the teachers and students' Perceptions on the use of Smart Classrooms in Secondary Schools. I hope you will take a few minutes to complete this questionnaire hence your ideas will help to complete this work.

Please be assured that your information will be confidential, and data will be presented in aggregate form.

Part A: Respondents' information

1. Gender: Male = 1 and Female = 2 ☐
2. Age: 13 - 15 = **(1)** 16 – 18 = **(2)** ☐

3: School Name …….

3. Class: ☐

Part B: Questions

1. How do you perceive teaching and learning process which takes place in the Smart classrooms using the technological devices such as computers, projector, and internet?
   a. Very motivated
   b. Motivated
   c. Not motivated
   d. Unmotivated

2. Please describe any factors that would motivate the use of Smart classroom in teaching and learning process in your school.
   .....
   .....

3. What types of learning activities used to take place in Smart classrooms?

Activities	**Agree**	**disagree**
Reading activities		
Writing activities		
Problem Solving Activities		
Practical demonstrations		
Research		

4. What other types of learning activities would you suggest being used in Smart classrooms?

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5. Describe the factors that slow down the efficient exploitation of Smart classrooms and the way forward

….....

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Appendix 4: Guiding questions for teachers

Dear Sir / Madam.

I' am a student at University of Rwanda- College of Education. I' am making research on the teachers and students' Perceptions on the use of Smart Classrooms in Secondary Schools. I hope you will take a few minutes to complete this questionnaire hence your ideas will help to complete this work.

Please be assured that your information will be confidential, and data will be presented in aggregate form.

Part A: Respondents' information

1. Gender: Male = 1 and Female = 2 ☐

2. Age: 20 - 35 = **(1)** 36 – 65 = **(2)** ☐
3. School name …….
4. Marital status. Married 1, Single 2, Divorced 3, widow/widower 4, ☐
5. Highest educational qualification: A1 ☐ A0 ☐ Masters ☐

Part B: Questions

1. How often do you integrate smart classrooms into your daily instruction? Choose one

a) In every lesson
b) One or more time per week
c) One or more time per month
d) Less than monthly
e) Never

2. Teaching and learning activities through smart classroom are better transmitted than in traditional way. describe your view

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3. As a professional teacher you are, rate what influence you to frequent Smart Classrooms and use it in your daily life process

Activities	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Developing lesson plan and other relevant teaching documents?					
Learning from expert teachers the updated pedagogical skills					
Preparing notes, different materials for teaching and learning process,					
to prepare different activities (assignments) to be provided to students.					
Searching various information that will strengthen my profession, self-studies, communication as well as updating myself through information to keep myself update and increase my confidence and competence in my subject of specialization					

4. What factors do you think can be done in order to encourage the use of Smart Classrooms for both teacher and student

Factors	Important	Not important
Reducing workload to provide opportunities to teachers for developing instructional materials		

Investments on in-service education programs for instructional technologies		
Increase number of smart classrooms		
Equip the whole school with the internet connectivity		
Carrying out the studies for integration of technology into curriculum		
Prepare model lessons in which technology is included		
Rewarding the efforts of teachers towards the use of Smart classrooms		
Others		

5. What is the interest of using Smart classroom in teaching and learning process? Please ***tick whether you agree or disagree with the statements listed in the table below***

Statement	Agree	Disagree
Using Smart Classrooms makes learning more effective.		
The use of Smart Classrooms increased the interest of students		
The use of Smart classrooms increased the quality of courses		
Usage of Smart Classrooms makes it easier to prepare Course materials (assignments, handouts etc.)		
Usage of Smart Classrooms helps to handle different learning preferences of students having different learning styles		

Usage of Smart Classrooms help to search for various information related to teaching		
Help to simplify teaching activities and help in time management.		
Get good, enough and satisfactory answers, when I get difficult questions from students		
Others (Specify) …		

6. **What types of learning activities do you use to achieve to learning objective through the frequentation of Smart classrooms? Please tick whether you agree or disagree with the statements listed in the table below**

Activities	***Daily***	***Weekly***	***Monthly***	***Never***
Create materials for Student Use (e.g., handouts, test,)				
Searching teaching and learning materials and preparation of lesson notes,				
Post information to a website to assist your students learning				
Online professionals learning				
Practical demonstrations				
Others (Specify) …				

7. **Indicate which technology resources hereunder are available for use in your school and whether you have used them.**

Devices	Is it available? Yes No	Have you use it? Yes No	Is it easily accessible? Yes No
Computer for teachers			
Computer for students			
Smart board			
Projector			
Internet connectivity			
Printer			

8. Please indicate whether you have undertaken professional development related to the use of Smart classrooms

Training type	Have you undertaken it? Yes No	Was it organized by REB? Yes No	Was it effective and enough? Yes No
Training in the use of computer			
Word processing			
Excel processing			
Power point presentation			
Training on how to use Smart classrooms in teaching			
Training in the use of internet connectivity			

9. What in your view are the main challenges to Smart classrooms use? Please *tick whether you agree or disagree with the statements listed in the table below*

Challenges	Agree	Disagree

Inefficient time to prepare lessons and materials based on technology		
Inefficiency of teachers' technical knowledge to *prepare materials based on technology*		
Problems about accessibility to computers		
Problems about accessibility to internet		
Shortage of computers (insufficiency of computers to cater for all students at once)		
Inefficiency of guidance and support by administration		
Lack of interest of teachers in technology usage		
Threat of theft of computers lead to poor utilization of smart classrooms as a way of protecting computer from thieves		
Others not included above ……..		

Appendix 5: Guiding questions for head teachers

Dear Sir / Madam.

I' am a student at University of Rwanda- College of Education. I' am making research on the teachers and students' Perceptions on the use of Smart Classrooms in Secondary Schools. I hope you will take a few minutes to complete this questionnaire hence your ideas will help to complete this work.

Please be assured that your information will be confidential, and data will be presented in aggregate form.

Part A: Respondents' information

1. Gender: Male = 1 and Female = 2 ☐
2. Age: 20 - 35 = **(1)** 36 – 65 = **(2)** ☐
3. School name …….
4. Marital status. Married 1, Single 2, Divorced 3, widow/widower 4,
5. Highest educational qualification: A1 ☐ A0 ☐ Masters ☐

Part B: Questions

6. **Rate what influenced you to have Smart Classrooms in your school.**

Activity	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Help teachers to prepare appropriately teaching documents					
Availability at the school (because you find your neighboring schools having them)					
Parents and students' influence					
Administrative influence (REB, District, Sector pressure)					
Professional development opportunities at the school					
Promote research and self-coaching among students					
Use Microsoft word, Excel and power point to present information to students and teachers					

7. To which extent are you integrating Smart classroom in teaching and learning process so that it can bring positive change to your school?

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8. How does Smart classroom facilitate the performance of administrative tasks in your school?

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9. What type of devices do you have in Smart classroom?

Devices	Available not available	Enough or not enough
Laptops (Positive)		
Smart board		
Projector		
Internet connectivity		Strong ☐ weak ☐
Sound system		

10. What challenges regarding the use of Smart Classroom do you face in your school and what do you think can be done to improve the effectiveness of Smart Classroom in your school?

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Appendix 6: Guiding questions for deputy head teachers (interview questions)

Dear Sir / Madam.

I' am a student at University of Rwanda- College of Education. I' am making research on the teachers and students' Perceptions on the use of Smart Classrooms in Secondary Schools. I hope you will take a few minutes to complete this questionnaire hence your ideas will help to complete this work.

Section 1: Identification

1. Names……
2. Gender……
3. School name…….

4. Level of education……

A. Interview guide questions for deputy headteachers in charge of studies

Q1. Based on your experience, tell how the establishment of smart classrooms align with the Mission and Vision of your schools.

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Q2. To which extend smart classrooms support teaching and learning process in your school?

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A. Focused group discussion questions

Q3. As deputy headteacher who daily monitor the teaching and learning process how do you perceive the new concept of smart classrooms in daily school activities including teaching and learning process.

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Q4. Discuss on the challenges hindering the effective implementation of Smart classroom in your school.

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