INFLUENCE OF APPLICATION OF BIOMETRIC MACHINES ON TEACHER PERFORMANCE IN TEACHING IN SELECTED PRIMARY SCHOOLS IN EASTERN DIVISION IN TORORO.

By;

OMALLA JOSEPHINE

REG NO:

BU/UP/2020/2909.

SUPERVISORS;

MRS. BIRUNGI TEDDY.

A RESEARCH DISSERTATION SUBMITTED TO THE SCHOOL OF EDUCATION IN PARTIAL FULFILLMENT FOR THE AWARD OF A BACHELORS DEGREE AT BUSITEMA UNIVERSITY.

JAN 2024.

DECLARATION

This dissertation is my original work and has not been presented in any other College or University for the award of a degree. All information obtained from other sources has been acknowledged.

OMALLA JOSEPHINE REG. NO. BU/UP/2020/2909.

Sign: Omalla ..... Date: 9-2-2024

i

APPROVAL

This dissertation has been submitted for my review and approval as the university supervisor.

Mrs. BIRUNGI TEDDY.
Academic Supervisor
Lecturer
Department of Education
Faculty of Science and Education,
Busitema University, Uganda.
Sign: Date: 9/02/2024

ii

DEDICATION

This research thesis is dedicated to my beloved family, my husband Mr. Nyakoli Wilson, children Priscilla, Enid, Hezron, Joselyne, Edrin, and Natasha, and grandchildren Elaine, Isaiah, and Aima.

iii

ACKNOWLEDGEMENT

I am greatly indebted to my supervisor, Mrs. Birungi Teddy for her academic guidance during the entire process of dissertation writing. The successful completion of this dissertation would not have been possible without her overwhelming support. Special thanks to all my lecturers and staff in the Faculty of Education who supported me throughout the course. I sincerely thank my beloved family for encouraging and motivating me during my studies. I exceptionally owe gratitude to my husband and children for tirelessly cheering me on. To them all; you are awesome people. Thank you for believing in me. Finally, I acknowledge the support of my classmates who made it possible for me to complete this dissertation. Special thanks to the staff at selected primary schools in Eastern Division, Tororo for availing information that supported my dissertation writing. May God bless them abundantly.

TABLE OF CONTENT

LIST OF TABLES

LIST OF ABBREVIATIONS/ OR AND ACRONYMS.

MOES……...… Ministry Of Education and Sport.
UPE……..… Universal Primary Education.
ICT…… Information Communication and Technology.
UID…… Unique Identifier.
AI…… Artificial Intelligence.
TELA……... Teacher Effectiveness and Learner Achievement.

ABSTRACT

The purpose of this study was to examine the influence of application of Biometric machine application on teacher performance in selected schools in Eastern Division, Tororo District. The study sought to answer research questions on the challenges faces during application of Biometric machines, possible solutions to those challenges and areas for improvement and the benefits that have accrued from the use of the technology so far from the lens of the teacher who is using it. The study intended to benefit the government, teachers, parents and all relevant stakeholders in the education sector. Literature related to the subject under study was reviewed accordingly. The study was guided by the Diffusion of Innovations Theory. The target population was all the four public primary schools, 60 teachers in Eastern Division, Tororo District. The researcher adopted a cross-sectional survey. Both probability and non-probability sampling procedures were used to select the sample which comprised five public primary schools selected through stratified sampling. The Head teachers were selected on simple random sampling and teachers were purposively selected. The respondents included 5 head teachers and 60 teachers. The research instruments used in the study included questionnaires for teachers, interview guide for head teachers, observation guide and document analysis guide. Demographic data on the respondents was represented on tables using percentages and frequencies. Qualitative data was presented in narrative form. The findings of the study revealed that the current system of attendance used in school is the Teacher Effectiveness and Learner Achievement (TELA). Whereas the teachers are willing to adapt the system, the system has a few shortcomings like failure to retrieve accurate data and occasional breakdown coupled with lack of both technical capacity of the users and the

technicians to help with regular maintenance, connectivity, software glitches, privacy concerns, accessibility and cost affordability. Strategies on how to improve the use of Biometric machine in the primary schools have been suggested. Recommendations on issues relating to Biometric infrastructure and use have been given. Finally, a number of areas have been suggested for further research.

CHAPTER ONE

1.1 INTRODUCTION

Information Communication and Technology (ICT) has increasingly become an important driver to everyday life and economic activity in the present day. From simple technology such as use of phone to now presently use of Artificial Intelligence, the rapid changes and revolution on the technology has enhanced ways in which information is captured, processed and transmitted in a fast, reliable and convenient manner. The importance of ICT is widely recognized in society today from business places, workspace to homes. With expanding educational system and the demands that the pandemic of COVID-19 disease put on the education system, virtual learning, biometric machine use and many other technologies are being used to facilitate learning. The use of ICT has therefore played acritical role in supporting efficient management and administration in education sector from student to resource in education institutions. A supervisor in public school has numerous roles among which are organising and management of school curriculum, financial, human resource management and maintenance of school equipment. Such responsibilities are enormous. Furthermore, increased enrolment through free primary education has led to increased workload. This in turn affects administration effectiveness in monitoring teacher performance. government therefore pioneered use of biometric machines to track teachers' attendance as a tool to improve teachers' attendance as well as performance and learning processes. Earlier studies also had alluded to the fact of sluggishness of the Africans in adopting the use of ICT innovation.

The study therefore will examine the influence of application of biometric machines on teacher attendance in primary schools in Tororo municipal council, Tororo District. Perception on biometric machines is the independent variable and teacher performance is the dependent variable. This chapter will explore the background of the study, problem statement, objectives of the study, research question, research hypothesis, justification of the study, significancy, the scope of s, study and conceptual framework.

1.2 Background to the Study

Computerized biometric attendance system with unique and improved identifier features are being used world over and over time now to monitor employee attendance in organisations (Akinduyite, Adetunmbi, Olabode, & Ibidunmoye, 2013). India for example is one of the nations with advanced and ambitious interventions on biometric such as the Unique Identifier (UID) with a major goal to create a unique biometric identity for every citizen of that country (Ramakumar, 2010). It has also done other projects for judges in Delhi courts (Sarda, 2009) and biometric attendance to track both students and teachers in all schools in Indian state (http://secuwatch.wordpress.com). The biometric technology is customized for single use only like education and may and its access is limited although they are readily available especially those for biometric authentication (Kirmani, 2017). This is exacerbated by lack of infrastructural resource. Hence biometric upgrade is required to improve administrative efficiency and addressing absenteeism since it will help with the issue of teachers leaving school early or not attending classes for personal reasons thus abandoning their teachers' duty. The India project is related to the Saudi Arabia initiative where the ministry implemented the biometric attendance tracking system in all schools across the country (Zhouheir & Shuaib, 2011) and as well the National biometric registry of all Saud Arabia citizen making the Aadhaar initiative the greatest (Khan, 2010). Its worthy noting that government officials in many countries now are getting to be monitored with the biometric technology, a step that is naturally making biometric attendance tracking find its way into school systems. For example, in Hangzhou Dianzi University in China developed an application for roll-call code named class-begins. It's powered by Artificial Intelligence (AI) to seize absentees and get the teachers back to classrooms. The system enables teachers to make class roll calls on the application, which takes less than 15seconds, the system will automatically make phone calls to absent students. A study conducted in Ghana revealed that biometric system id good for management of teacher's attendance and had reduced teachers' absenteeism in the country from27% to 11%, a remarkable improvement it was (www.thebftonline.com, 2014). Whereas they also revealed that its use was dependent on the strength and speed of the GSM network technology implying its use would be limited in this regard as earlier allude by Charles,

(2009). In Kenya , the biometric system is under rare used schools though some institutions and state house have deployed their use (Study, 2020).

Biometric machine uses generally aimed at the improvement of service delivery in hospitals, schools and many government institutions by the government of Uganda. Therefore, this research aims at providing empirical data about the challenges faced by teachers on application of Biometric machines in selected schools in Eastern division, Tororo and chant possible remedies to those challenges.

1.3 Statement of the Problem

Every institution is desirous of good and well performing staff and this is not an exception for primary schools in Tororo municipal council. Quality and better performance is evidenced by a number of things such as good time management in classroom in regards to timely setting and marking of exams, syllabus coverage, punctual attendance and timely lessons attendance and observance of planned activities. Regularity at school gives certainty toa good learning environment as there is increased contact time and building of a good teacher-student relationship and a good atmosphere creates the latitude for students to consult more. Evidence of a well-documented lesson plan with key outputs and learning objectives clearly stated and achievable is an indication of good performance.

Absenteeism is becoming of increasing concern in most schools in Tororo municipal council because some teachers receive payment without going for classes, which results, to waste of government resources. Again, while the financial costs are important, the education costs are the most significant. This is because when teachers get miss school frequently it leaves students unattended, moreover teachers' absenteeism reduce the amount of teaching time and thus resulting to syllabus being incomplete or not well covered. Consequently, this results to low results by students (Ubongo, 2004). Bray and Percy (2003) noted that teacher's absenteeism has a remarkable impact on nations education system hence teachers' absenteeism affects students' performance negatively. This has been evidence in declining student performance over the year this has been consistent over the years despite the push for better welfare to the teaching staff by the Ministry of Education and sports (MOES) in improving performance of teachers by posting

enough teachers in Universal Primary Education (UPE) school, increasing their salaries and providing scholastic materials.

Government therefore devised mechanism to curb this problem by installing biometric machines in Primary schools to help monitor teachers' attendance and improve their performance at school but all these efforts have not yielded the much needed and desired outputs.

1.4 Objective of the study.

1.4.1 General objective

To examine the influence of application of biometric machines on teacher performance in primary schools in Tororo municipal council.

1.4.2 Specific objectives

1. To identify the challenges that teachers face in the application of biometric machines in selected schools in Eastern division, Tororo.
2. To establish solutions and improvements on the challenges teachers face in the application of biometric machines in selected primary schools in Eastern division, Tororo.
3. To establish the benefits and influence of biometric application on teachers' performance and in selected primary schools in Eastern division, Tororo.

1.5 Research questions

1. What are the challenges faced by teachers in the application of biometric machines in selected schools in Eastern division, Tororo?
2. What are the possible solutions to the challenges encountered and improvements that can be made on the application of biometric machines in selected schools in Eastern division, Tororo?
3. What are the benefits and influence on teachers' performances of biometric machines application in selected primary schools in Eastern division, Tororo?

1.6 Significance of the study

The findings shall be used by MOES to enforce existing policies and advocacy to improving teacher performance and improve on how to track teacher attendance better and also integrate ICT into learning including virtual learning for improved learning. It will

also help inform government of the hinderance of integrating ICT in learning and teachers' performance to ensure successful use of ICT in schools. The research will capture perception of teachers in line with use of Biometrics machine and ICT to help policy makers and decision makers arrive at well informed decisions.

The findings of the study shall help Head teacher and staff at the school to identify and bridge the attendance gaps, and improve teachers' welfare aspects that may lead to poor attendance to school needs. Furthermore, the study will benefit in building knowledge gap based on perception of teachers on use of biometrics machine as a tool for monitoring teachers' performance. Hence further resistance may be avoided by any new technology to be used as a school administrative strategy to monitor performance and also help in overcoming new challenges. The study may also reveal factors that caused poor perception on the use of ICT to monitor teachers' performances.

The knowledge from this study shall enable parents and communities to consider investment in ICT as a priority for timely and efficient delivery of services. Finally, the study shall help future researchers to make references on this work with the aim of building more knowledge in the field of ICT and educational administration.

1.7 Scope of study

1.7.1 Geographical scope

The study was conducted among the teachers of primary schools within Eastern division, Tororo municipality which are government aided primary schools. The schools are in Tororo District, Eastern Uganda. This was to examine the influence of application biometric machines to teachers' performance in selected primary schools in Eastern division, a strategy which was employed to improve performance despite schools still registering low performances at national levels.

1.7.2 Contextual scope

The subject for study was limited to influence of application of biometric machines on teacher performance. Perception was measured by perceived ease of use, perceived

usefulness and satisfaction. Perception of ease of use is the effortlessness on the use of the biometric system. Perceived usefulness is the degree to which the teacher believes the biometric application has enhanced performance with intervening variable such as availability of the machines, technical support, and literacy in order to achieve intended outcomes of timely reporting, effective monitoring of students' progress etc. and satisfaction is how the usefulness of the application influences attitude towards use of the technology

Teacher performance was constituted by efficiency in attendance, timely reporting, and improved overall performance as intended outcomes of the intervention. This is due to the assumption that investment is made in ICT as an intervention to improve learning outcomes in terms of improved performance but little has been achieved.

1.7.3 Time scope

The study considered the general performance of teachers between the year2021-2023. This was the time the school adopted use of biometric machines to track attendance of teachers in schools and school activities in order to improve general performance and yet there seems to be little impact obtained from the intervention.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviewed literature in regards to the research work from different scholars and publications to understand the concept and context clearly and to apply it in the research work.

2.1 Biometric system

Biometric machine is any tool that uses an automated or semi-automated process to aid in verification of a person's identity based on his physiological or behavioural characteristics (office of information technology service, 2023)(office of information technology service New york, 2023). Such feature may include finger prints , iris , facial and retina (*IDENTIFICATION IN HIGHER INSTITUTIONS OF LEARNING USING BIOMETRIC*, 2019). Biometric technology is becoming relevant in a number of ways and important in securing useful information, offering unique identification and verification solutions(Study, 2020). One of the most recognised and well-known and used authentication is the fingerprint because of its uniqueness and consistency and this is becoming more automated and advanced (Atam, 2017). It's easy to use and cheaply available. Studies by Wandera et al., (2019) reveal a shift in technological advancement and with globalization it's imperative to find easier and effective ways to improve employee productivity hence a paradigm shift from the old fashion way of data collection and record keeping for example on attendance of employees (Hernandez-de-Menendez et al., 2021). Staff attendance management system is key in achieving organizational goals but also track of performance and do manpower analysis for easy transfer to the payroll system. Study by Fairhurst et al., (2017) pointed out that biometric system is the most authentic system since it authenticates using the persons thumb impression and is useable for both students and teachers is a school system. Data stored by the biometric can be used to develop and design automated students' attendance. A study by (Salome, 2019) also reveals that biometrics is often very useful for registering students and staff attendance , data collected can cheaply be maintained and records kept.

Hernandez-de-Menendez et al., (2021)stated further that finger verification was more authentic than other methods of verification, as it would check a person's fingerprint. It's easy to use and cost effective and easily portable (Hoo & Ibrahim, 2019).

2.2 Understanding the Installation Process of Biometric Machines

The installation process of biometric machines in educational settings requires careful consideration and planning (Muhtasim et al., 2022). Conducting thorough risk assessments and consulting with relevant stakeholders, including teachers, parents, and students, are essential steps in the installation process (Eegdeman et al., 2022). Additionally, the deployment of biometric technology should be accompanied by comprehensive educational sessions to address any concerns and misconceptions about the use of biometric data (Kim, 2023) (Ma et al., 2023).

Furthermore, the selection of biometric systems should prioritize those that offer robust data security measures and privacy protection features(Vibert et al., 2023)(Kloet & Yang, 2022) (Khade et al., 2021). Implementing systems with encryption capabilities and secure storage of biometric data can alleviate concerns about potential data breaches and misuse of sensitive information (Vibert et al., 2023) (Oliveira et al., 2022) (Patil et al., 2022).

2.3 How Biometric Fingerprint Works

Foe reasonably good years, biometric system has very much relied on fingerprint identification. Each of the ten fingerprints is solely identical to one person and even identical twins never can share a fingerprint hence making it ideal for personal identification. Fingerprints are made ridges and furrows on the finger surface. The uniqueness of a print is determined by the patterns and minutiae points which are characterized by a ridge splitting apart. Finger scanning uses flat images of only two fingers to create templates. When fingers are placed flat, the images will require only minimum unique identifying points to make a match. The purpose is to match the being enrolled in a particular software. Upon return to the scanner to be authenticated the finger scanner again scans the finger and the computer software compares the new template and the old one captured in the database during enrolment and when the matching one is found the person is authenticated and this takes precisely about one –two seconds. A study by

(*IDENTIFICATION IN HIGHER INSTITUTIONS OF LEARNING USING BIOMETRIC*, 2019) revealed that finger print scanning is the acquisition and recognition of a person's fingerprint details for identification through quantifiable physiological traits that identify that individual.

2.4 APPLICATION OF BIOMETRIC TECHNIQUES.

A number studies have pointed out on the application areas foe biometric machines. For example Atam, (2017) identified school access as one users of biometric system. For a school a control environment is critical for achieving academic goals and providing enhance security hence access to schools is only permissible to authorised persons (Study, 2020). It can be easy to monitor students, staff and frequent visitors accurately using the biometric scanning technology. The attendance of every individual in terms of time and date on which they had access is easily retrievable and such records can useful. School administrators are responsible for accurate record keeping especially for government aided schools since funding is dependent on the number of students a [articular school has (). Proof of school attendance can only be provided by the login logo and data captured by the biometric system. Similarly in schools the library system offers access to books borrowed and track usage and eliminating library cards

Biometric machines also find their use in payment systems where cards are swiped or pins are inserted and this is fostering the economic transformation to a cashless economy.

2.5 Biometric Machines in Primary Schools

Biometric technology has the potential to revolutionize the way schools operate and enhance the learning experience for students (Figueroa et al., 2023) (Orhan & Gursoy, 2023). One possible solution involves the combination of a smart card and biometric recognition using fingerprints, which offers more secure and easier access control for computers than traditional password methods (Thales, 2023) (ButterflyMX, 2022) (Meshram, 2022) (Khade et al., 2021). The adoption of biometric technology could address the challenges associated with traditional authentication methods and streamline access to resources such as library checkouts and computer labs (Hofbauer & Rodriguez, 2022) (Silva & Parente, 2022). Moreover, the application of biometric technology can extend

beyond security and attendance tracking (MDPI, 2023) (Muhtasim et al., 2022). It has the potential to support and enhance the learning process by facilitating easy access to academic resources and providing students with a more organized and efficient learning environment (Morgan et al., 2023) (Gordillo-Tenorio et al., 2023). Biometric machines are advanced technology systems that are being increasingly integrated into various sectors for enhanced security and efficiency. They utilize unique physical or behavioural characteristics, such as fingerprints, iris patterns, facial features, or voice recognition, to verify and authenticate the identity of individuals (Cui et al., 2018) (Chen et al., 2021). The use of biometric machines in primary schools has gained popularity due to their ability to accurately verify the identity of students and faculty members, thus enhancing security measures within the school premises. These machines not only provide secure access to school facilities but also streamline attendance tracking, making it more efficient and convenient for both students and staff (Rukhiran et al., 2023).

In addition to security and attendance tracking, biometric machines in primary schools offer potential benefits such as simplified library checkouts, secure access to computer labs, and meal tracking in school cafeterias. The implementation of biometric machines can contribute to a more organized and streamlined daily operation within the school environment (Ibrahim et al., 2022) (Hernandez-de-Menendez et al., 2021)(Farazdaghi et al., 2021)(El-Ghandour et al., 2021). Furthermore, by using biometric machines in primary schools, the risk of unauthorized access is greatly reduced (Rukhiran et al., 2023)(Muhtasim et al., 2022).

2.6 Benefits of Using Biometric Machines in Education

The benefits of using biometric machines in education are numerous. With the use of biometric technology, schools can ensure accurate and efficient attendance tracking, minimizing the possibility of errors and unauthorized access. This not only improves overall security within the school premises but also contributes to a more organized and secure learning environment (Hazrati et al., 2022) (Hernandez-de-Menendez et al., 2021) (Kim et al., 2020). Implementing biometric machines in primary schools also simplifies the process of library checkouts, granting secure access to computer labs, and tracking meal

usage in school cafeterias, ultimately enhancing the overall efficiency of daily operations (Rosário & Dias, 2023) (Wambui et al., 2022).

The integration of biometric machines in primary education has proved to have numerous advantages beyond just security and attendance tracking (Amiribesheli et al., 2015) (Farazdaghi et al., 2021) (Leghari et al., 2021). With the use of biometric technology, schools can create a more streamlined learning environment by ensuring that students have easy and secure access to library resources, computer labs, and other academic facilities. This not only enhances the efficiency of daily operations but also provides students with a sense of security and belonging within the school premises (Stamatis & Chatzinikola, 2021).

Moreover, the incorporation of biometric machines contributes to the advancement of technology in education, aligning with the global trend of integrating technology into learning processes (Khaldi et al., 2023) (Harahap et al., 2022). As primary schools embrace the use of biometric machines, they are demonstrating a commitment to staying at the forefront of educational technology (Leghari et al., 2021). By implementing biometric machines technology in primary schools, the institutions are not only enhancing security and attendance tracking but also promoting a more efficient and organized learning environment (Yan et al., 2022) (Information, Communication & Technology Usage and Students' Academic Performance in Public Secondary Schools in Rwanda, 2022) (Durukan et al., 2022).

2.7 Challenges and Concerns Regarding Biometric Technology.

The integration of biometric technology in primary schools undoubtedly brings numerous advantages, such as improved security, efficient attendance tracking, and streamlined access to various facilities. However, alongside these benefits come challenges and concerns regarding the use of biometric technology in educational settings (Kaklauskas et al., 2022) (Ismail et al., 2022)(Ponce-Hernandez et al., 2020). One of the primary concerns is related to privacy and data security. With the extensive use of biometric data, there is a growing apprehension among end users about the safeguarding of their information (Doseděl et al., 2023)(Kaklauskas et al., 2022). This concern is further exacerbated by the

potential misuse of the captured biometrics information and the need for effective protection mechanisms (Doseděl et al., 2023).

Public acceptance is majorly the main reason behind the under development of biometrics and massive use since there is fear among users leading to annexation of their privacy (*IDENTIFICATION IN HIGHER INSTITUTIONS OF LEARNING USING BIOMETRIC*, 2019). Most organisations use and store information about numerous databases on the biometric identifier hence they are afraid the organisations may use such information to track their activities and performance or even share such with other organisations probably without their knowledge.

There is a school of thought that government may use this information to track their daily actions hence having total control over their lives for many reasons including security monitoring (Hernandez-de-Menendez et al., 2021). For personnel in security there is high complex level of security of the biometric system which ordinarily the users in the security circle feel are avoidable for everyday life due to its complexity. Cultural believes may also affect the perception of use of biometric machine that may bring about hesitancy. This is because of the perceived privacy breaches that they assume comes in with its use (Fairhurst et al., 2017). Whereas it's difficult to falsify biometric identifier, it's not impossible, hence behavioural identifiers like signature and voice may be easily forged by mimicking voices and forging signatures unlike in physiological biometrics and relatedly with growth voices change with age as shown by studies undertaken in Nigeria (Atam, 2017). Fingers can also be faked using a silicon in hand biometrics and this greatly possess a challenged in its use (*Fingerprints & Feet*, 2019). The biometric identification can also be breached where an individual can breach one of the two major stages namely one can present the right credentials during the enrolment which converted to the template and stored and the false one can be presented as well during the verification process and the system will one captured the credentials of the enrolment and update the new identifiers on the during verification which is accepted later by the system and such individuals who breach the system can easily engage in illegal activities(*Fingerprints & Feet*, 2019) . Errors may need to be monitored in the biometric system and fixings of bugs from time to time, this implies that administrative authorities will need infrastructure of information technology (IT) and other ICT tools to enable proper connectivity. Studies by *Fingerprints & Feet*, (2019)

reveals that poor and regular interruption of electricity supply at different educational institutions may also pose a challenge. More studies as well by Affairs, (2021) present that the biometric technology is not fool proof hence the issues of reliability on them is still a concern, their cost of deployment in every institution building foe easy access by users is hefty and expensive considering the cost of software, hardware, training users and enrolling new users for organisations and schools are pretty expensive. Other studies by office of information technology service,(2023) decried the inaccuracy of biometric machines as the verification and positive identification may allow unauthorized users access to facilities due to incorrect matches or may sometimes deny users access due to negative identification. Other studies have also alluded to use of passwords as more convenient to log to any system than using of fingerprints hence are resistance to change.

2.8 The Future of Biometrics in Schools

The future of biometrics in schools is promising, with the potential to revolutionize various aspects of education (Rukhiran et al., 2023). As biometric technology continues to advance, it can offer numerous benefits, such as enhancing security, streamlining administrative processes, and facilitating a more efficient learning environment for students (Hussein & Rashid, 2022) (Wu et al., 2022) (Agrawal et al., 2021).

In addition to access control and attendance tracking, biometric systems can be integrated into other areas of school management, such as library checkouts, cafeteria management, and secure access to sensitive information (Importance of the Biometric Integration Feature in Schools, 2023) (Yang et al., 2022). This integration not only enhances security but also improves the overall operational efficiency of educational institutions (As more biometric data is collected in schools, parents need to ask ..., 2022) (Guirou et al., 2021).

Furthermore, the adoption of biometric systems in primary schools can instill a sense of responsibility and accountability among students, as they are required to actively engage in the verification process and understand the importance of accurate identification (AL-Ghamdi & Ragab, 2022). Using biometric machines in primary schools can greatly improve the efficiency and security of various processes (Orhan & Gursoy, 2023)(Shahbakhsh & Hassanpour, 2022)(AL-Ghamdi & Ragab, 2022). It can also help in accurately tracking the attendance of students, reducing cases of proxy attendance and

ensuring that only authorized individuals have access to school premises (How School Management Software Simplifies Administrative Tasks, 2023)(Kiral & ÖZTABAN, 2022)(Wang, 2022). Moreover, the use of biometric technology in primary schools can simplify administrative tasks for teachers and staff, freeing up time that can be better spent on educational activities (Figueroa et al., 2023).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

Chapter three focused on how the study will be conducted, the research designs, description of the geopolitical and cultural nature of the Teachers of Tororo Municipal Council, the data collection criteria, tools and sample size and population determination including validation protocol and data analysis and dissemination plan of the findings of the study.

3.2 Research Design

This study used a qualitative method which according to (Thomas, Garry 2014) offers high capacity for exploring the issue under examination through the in-depth information derived from the methodology. This allowed participant to share feelings and thoughts. Its strength was allowing exploration and accessing information on problems as participants freely express their opinion, feeling, experiences and personal thoughts.

3.3 Population of the study

The study was conducted among schools that are using the biometric machine with in the municipal council, it was done among the teachers and school administrators. Most of the teachers who have been interfacing with the biometric machines for the first time and there were fears and challenges encountered in its usage and application. Whereas its governments move to have school staff enrolled into biometric system to track their classroom attendance and effectiveness in teacher performance, the technology as well comes with challenges that are faced during implementation which may slow down, or even sabotage its usage hence it's important to review of performance in order to make improvement.

3.4 Sampling techniques and sample size

In order to come up with appropriate sample size of 60 participants for the study from the population of, the Krejcie and Morgan (1970) table of determining samples in social research was used. However, the number of respondents that successfully returned forms were 50 that is inclusive of both teachers and the headteacher

Table 1.1 below presented the detail of sample size determination and selection from appropriate population.

Table 3.1: ***Showing population, sample determination***

Participant's category	Study population	Sample size	Sampling technique
Administrators	5	5	Simple random sampling
Teachers	55	55	Purposive
Total		**60**	

Source: *Ministry of Education and Sports (2022).*

The study used a simple random sampling to select the schools and their school heads and a purposive sampling to select the teachers. This method was appropriate because it allowed for selection of participants who have adequate knowledge on application of biometric machines in order to solicit detailed information. The teachers were recruited with the aid of the school administrators. These participants and the schools that were selected for the study will be based on criteria set up for the study.

Out of the schools in Tororo municipal council, five (5) were selected because of they have the biometric machines installed and they are presumably using them and reporting consistently but also has the highest number of students and staff hence the space size is a significant value of the population. The teachers selected for the study in consultation with the school administrators were based on the level of interactions and comprehension and usability of the biometric machines. They helped the researcher obtain information on challenges faced during use of biometric machines in their respective schools, related solutions and improvements that can be made for effectiveness in teacher performance. The administrators helped in suggesting the possible solutions to teachers challenges and also give alternative improvements to the biometric machines to improve its efficiency and elucidated on how beneficial the use of the Biometric machine has improved the performance of teachers in their respective schools.

3.5 Data collection Methods and Instruments

Primary data was collected using interview guide to carry out the one-on-one interviews, narrations through which participants shared their experiences.

One-on-one interviews was used to collect data on individual experience, narratives and knowledge on effectiveness and challenges in application of biometric machines, the possible solutions to these challenges and the suggested modifications on the application of biometric machines use.

Data from interviews helped in proposing the alternative ways of encouraging the application of biometric machines in primary schools for better teacher performance while considering the welfare of teachers.

3.5.1 Field entry procedure

Prior to data collection, the research protocol of the study was submitted to Busitema University for approval. This approval letter from Busitema University guided on how data collection was handled considering the health safety protocols such as Ebola and COVID19.

The school heads/ administrators helped introduce me to the teachers and other participants. I discussed the objectives of the study to all participants and assured them of the confidentiality as a part of rapport building.

3.5.2 In-depth Interviews

The researcher engaged the participants on one-on-one in-depth interviews in the field, each interview lasted averagely 40 minutes and it was on prearranged basis depending on the convenience of the participant, researcher. Since it was during school learning time, interviews were conducted during breaks and free times of the respondents. It covered broadly demographic, narratives of experience of challenges faced in the application of biometric machines, proposed solution and modification or improvements that can be made on application of biometric machine in schools and impact of the application of biometric to teacher performance.

3.6 Quality Control Methods

In the current study, guidelines were respected to ensure trustworthiness by choosing a capable research approach, suitable participants with application of purposeful sampling techniques, engagement with participants during data collection, member checking and peer reviewing for universality of the findings, employment of triangulation and participant dairies to ensure dependability and confirmability. The external audit trials were done. Additionally a precise final report was provided on the research process to enhance transferability (Shenton, 2004).

3.7 Data Analysis Techniques

Both primary and secondary data were collected and analyzed by thematic and content analysis and was guided by research questions and supported by related literature. Thematic analysis is reiterative technique of organizing unstructured data into essential themes that give a meaning information. According to (Pope, Clive & Mays, Nicholas, 1995) content analysis is a systematic analysis of information through classification and coding and forming of group themes. This approach was most appropriate as it involved different study participants with various views that were needed to be put in perspective for clearer and better understanding. Hence content and thematic were used to structure variant views of the participants. The data was categorized into themes based on the topics and objectives of the study. They included responses on challenges faced in application of biometric machines, perceived solutions to the challenges and improvements that could be made or gaps to be addressed in application of biometric machines in schools. The analytic strategy was employed as an inductive approach that focused on the experience of participants who are faced with challenges in the application of biometrics (Cloke et al 2004). The process begun with the analysis of the field notes, transcription of data from participants and formation of themes and the final analysis using content analysis.

3.8 Ethical Considerations

Due to the sensitivity of the study information, confidentiality and anonymity of the study participants was ensured and this was done by signing a consent form after they have been talked to about the research objectives and pseudo names were given for anonymity.

The interviews were conducted in private with the researcher and one participant at a time. Cloud storage of the data obtained was considered during data collection for security reasons and privacy.

3.9 Anticipated Constraints

Some participant feared to provide information about the challenges they faced during application of biometric machines. This was addressed by assuring the respondents about the confidentiality of the information they would give during interviews.

Time was a limiting factor for the teachers since data was collected during school time and thus teachers planned lessons were interfered with. This was countered by being precise and was done only on free times and off duty time like break and lunch time.

3.10 Dissemination plan

The findings were be presented to the faculty of Education and the review board of Busitema University. The implication of the findings was shared with the school authorities and education systems. A copy of the bound report was availed to the library of Busitema University and the Municipal inspector of school, Tororo.

CHAPTER FOUR:

PRESENTATION, INTERPRETATION AND DISCUSSION OF FINDINGS

4.1 Introduction

This chapter presents the results and analysis within the framework of the set study questions, which is presented in tables and figures. It presents the rate of return and demographic characteristics of the respondents who are teachers and head teachers in the sampled schools in Eastern Division, Tororo District. The chapter also discusses findings of the study under the following headings: (i) the challenges teachers face in the application of biometric machines, (ii) solutions and improvements on the challenges teachers face in the application of biometric machines and (iii) the benefits and influence of biometric application on teachers' performance and in selected primary schools in Eastern division, Tororo.

4.2 Rate of Return

The researcher administered a total of 60 questionnaires to the sampled teachers in 4 primary schools in Eastern division, Tororo. However, 50 respondents returned their questionnaires to the researcher. This gives 83.3 % of the rate of return. According to Owens (2002), a return rate of 75% and above is deemed representative a study since it reduces the level of sampling bias.

4.3 Demographic characteristics of participants

The demographic characteristics of the participants covered in this section are gender, age, academic qualifications, working experience

Table 4.1 showing the demographics, gender, age, academic qualification and working experience of the respondents

	F	%
Gender		
Male	26	52
Female	24	48
Age		
<25 years	00	00
26-35 years	08	16
36-45 years	22	44
46-55 and above	20	40
Academic qualification		
Grade III teacher	20	40
Diploma holder	20	40
Bachelors degree holder	10	20
Length of study at school		
<5 years	18	36
6-10 years	24	48
11-16 and above	08	16
Experience in years		
1-10 years	08	16
11-20 years	24	48
21 and above years	18	36

Table 4.1 shows that 52% of the teachers in the study were male, whereas, 48 % were female. This difference can be attributed to the response trend where more male teachers responded to the questionnaires than their female counterparts as a result of simple random sampling. It could also be due to the fact that mole male respondents teach in rural schools than their female counterparts. The results in Table 4.1 also shows that none of the

respondent teachers was below the age of 25 years,16% of the teachers were aged between 26-25 years, 44% between 36-45 years and 40% aged from 46 years and above. This shows that most teachers were relatively mature in terms of age. Hence, they were able to provide relevant information on the application of biometric machines in their respective schools. Concerning the teachers' academic qualifications, Table 4.1 shows that 40 % were grade III teachers, 40% were Diploma holders and 20% had a Bachelors degree. This means that all respondent teachers had passed through a system of education where different communication channels about the application and use of ICT have been employed hence, they were aware of technological changes in the educational sector. According to Rogers (2003) communication channels used to spread word about an innovation determines its rate of adoption. Regarding their study at the current schools 36% of the respondent teachers had taught in their current schools for less than years, 48% had taught for 6 to 10 years only 16% had taught for 16 and above years, 7.1% had taught for 1 to 5 years, while 4.3% had taught for over 21 years in their current school. This shows that a good number of the respondent teachers had taught in their respective schools for a significant period of time they were in a better position to address the items in the research instrument on use of ICT in administration of their respective schools with the understanding of the prevailing ICT infrastructural conditions. And in respect to working experience 16% had been in school system for between 1-10 years, 48% had been in school teaching system for between 11-20 years and 36% years had been teaching system for over 21 years and above. This represents a significantly older generation who may not be flexible with technological adaptations and may be the majority that face significant challenges with use and application of biometric machines.

The study inquired on the type of school attendance system currently under use, and the teachers all answered pointing to two major system that is the manual arrival books and the newly introduced biometric system. The study found out that the biometric system is the TELA (Teacher Effectiveness and Learner Achievements) system of attendance which uses the Iris as the login credentials

4.4 Challenges faced by teachers in the application of biometric machines

A study was conducted to analyze the challenges faced during the use of biometric machines in primary schools. The study utilized the content analysis method to examine the experiences and issues encountered by schools while implementing biometric machines for attendance and identification purposes.

The teachers were asked to comment on the challenges faced during the application of biometric machine in their attendance. Generally, the teachers were willing to take up and adapt the new technology despite the problems faced in its use. They also pointed out that even though ICT facilities that were available in their respective schools were inadequate, ICT interest among teachers was high and most of them were actually looking forward to its full implementation and use in school administration in all schools. Head teachers further indicated that, more teachers had started using the biometric because it was convenient and had reduced the tedious manual processes of logging in and out.

Despite such interest, the study revealed several key challenges faced by primary schools in using biometric machines. These challenges include technical issues such as connectivity problems, software glitches, and hardware malfunctions. And this indicates the need for robust technical support and maintenance strategies. one of the teachers said:

"In some cases, the system jams, breaks down and keeps rejecting people's faces and sometimes improper credentials pop up upon recognizing one's face"

Other challenges identified were privacy concerns and data security breaches, which raised ethical and legal issues. The study found that primary schools faced difficulties in integrating the biometric machines into their existing systems and faced resistance from some teachers due to privacy concerns. One teacher responded and expressed his opinion saying:

"If the TELA machine is to continue then let us use the pin or codes without our faces, since the machine is bad, it reports teachers"

The study also highlighted the issue of cost and affordability, as some schools found it challenging to allocate funds for the purchase and maintenance of biometric machines. Additionally, the financial constraints and difficulties in allocating funds for biometric machines by government highlight the need for sustainable and cost-effective solutions that prioritize the long-term viability of such systems in primary schools.

One of the respondents said:

"Sometimes there is no battery in the biometric machine and lack of data for synchronizing information on the machine, and no money to update the system hence is sometimes fails to update itself"

Furthermore, the study found that schools struggled with training staff members on how to effectively operate and troubleshoot biometric machines. The challenges identified in the study underscore the complexity of integrating biometric machines into primary school systems. One this one of the respondents said:

"The machine can capture different faces bringing about some confusion and teachers abandon the machine because they have little knowledge on how to operate the TELA machine"

There is also a challenge of accessibility as the machine are only available when the schools' heads are within the schools. This creates a gap in the entry of data in case of any eventualities where the school head is unable to be at school, for that day there will be no data captured and the machine will not give a true reflection of the attendance of the teachers. This in the long run may be demoralizing to the users and staff

Addressing the challenges identified in the study requires a multifaceted approach that encompasses technical support, policy review, stakeholder engagement, and financial planning. Furthermore, training programs for staff members should be comprehensive and ongoing to ensure the effective operation and troubleshooting of biometric machines. This study sheds light on the nuanced issues surrounding the adoption of biometric technology in primary schools and calls for a holistic approach to mitigate these challenges.

The findings in this section reveal that challenges of application of biometric system are numerous which concur with other findings such as *Fingerprints & Feet,* (2019) who points out power interruptions to be among the challenges of using biometric machine.

4.5 Areas of improvement and possible solutions to the challenges faced

The study further sought to establish strategies used to improve and solve the challenges of application of biometric machine. The teachers were asked to give suggestions on what should be done to improve on the use of Biometric machines in their respective schools.
To address the identified challenges, the study suggested the need for schools to invest in robust technical support to ensure the smooth functioning of biometric machines. One of the respondents said this in relation to solving the challenge lack of knowledge

---

"In my opinion I think it would be good if every teacher would be trained how to handle the system /biometric machine"

It also recommended the implementation of stringent data protection measures to alleviate privacy and security concerns. Furthermore, the study proposed conducting awareness programs for parents and students to address the misconceptions surrounding biometric technology and its use in schools. Additionally, the need for financial assistance or subsidies for schools to acquire and maintain biometric machines was emphasized to mitigate the issue of cost and affordability. One respondent said

"Every school should have at least two machines that are available at the teacher's disposal all the time"

Overall, the study underscored the importance of a comprehensive approach that takes into account technical, ethical, legal, and financial aspects to effectively address the challenges associated with the use of biometric machines in primary schools.

The findings in this section show that the use of Biometric machine in primary schools is coupled with a myriad of challenges the most obvious being lack of ICT skills. The suggestion provided by teachers is similar to an observation by that ICTs are swiftly evolving technologies, however, even the most ICT fluent teachers need to continuously upgrade their skills and keep abreast of the latest development and best practices. Hence need for continuous training. Similarly, Way and Webb cited in Neyland (2011), agree that professional development for teachers is a critical factor in the integration of ICT in schools. High costs of biometric technology infrastructure call for adequate funding of the schools for acquisition of basic ICT infrastructure such adequately equipped and consistently powered computer labs. Schools also require sufficient ICT support for instance, ensuring that there are enough curriculum-oriented computer programs and internet connection to each school.

4.6 Benefits and influence of biometric application on teacher performance

Teachers were asked to suggest how impactful has the use of biometric machine been to their performance and a similar question was put across their supervisors, and a number of findings were made during the study. Biometric machines offer several benefits when used in primary schools. One major advantage on teacher performance is the sense of responsibility and discipline among teachers in terms of observing and staying until their right time to log out. By actively engaging with the biometric system for tasks such as attendance, teachers have developed a greater understanding of the importance of punctuality and regularity. One of the respondents said:

"It has eradicated escaping from school before time, motivating us to come early and start lessons early"

Furthermore, the use of biometric machines can also streamline administrative tasks such as attendance tracking. With the implementation of biometric technology, schools can accurately record and monitor teachers' attendance, reducing the potential for errors and ensuring that accurate data is available for administrative and academic purposes and this has also affected the student performance. One respondent said:

"Teachers are much more cautious about time management and this is impacting positively on pupils' performance"

Moreover, the integration of biometric machines in primary schools can also lead to an improvement in overall efficiency. With streamlined attendance records and secure access control, teachers and school administrators can devote more time and resources toward educational initiatives and student engagement rather than administrative tasks. This is particularly significant in primary schools, where a positive and conducive learning environment is crucial for a child's educational development.

In conclusion, the adoption of biometric machines in primary schools offers a range of benefits that contribute to enhanced security, improved administrative efficiency, and the cultivation of a responsible and disciplined attitude among students.

The findings imply that the effects of using TELA machines in primary schools are mainly in the form of efficient and quality work, reduced time wastage by teachers in terms of absenteeism, and there is conveniency in record storage and retrieval. These findings concur (Rosário & Dias, 2023) (Wambui et al., 2022) recognizes implementing biometric machines in primary schools enhancing the overall efficiency of daily operations.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of findings and conclusions drawn from the study. The chapter also gives recommendations and suggestions for further research.

5.1 Summary of the study

The main purpose of the study was to examine the influence of application of biometric machines on teacher performance in primary schools in Tororo municipal council. The study was guided six questions for the teachers and four for the headteachers. Related literature was reviewed on ICT use in Education and application of biometric machine in primary schools, national ICT policy frame work, perceptions, challenges and strategic use and improvement on use of biometric machines in schools. However, the literature reviewed didn't reveal any study on the influence of application of biometric on teacher performance in Eastern division of Tororo. The study used a cross sectional survey research design. Purposeful and simple random sampling procedures were used to arrive at the sample of teachers, while purposive sampling was used to select the heat teachers. The sample consisted of a total of 45 teachers and 5 headteachers. Content analysis was used to analyse and descriptive statistics such as percentages and frequencies are presented on the tables. The findings disclosed that key biometric machine being used by teachers are the TELA machines. The equipment however at times is affected by network, some reject login in credentials and lack of data and power in most schools affects its application. Another finding was the need to regularly update the Tela machine and routine maintenance and training of individual teachers on the use were the possible ways to solve the challenges of Tela machine use. Additionally, the findings also revealed that improvements can be made by establishing service centres at the district, provision of more machines by upscaling, installation of solar systems to curb power shortage and alternative login in options apart from Iris probably use of pins. The findings also revealed that majority of the teachers acknowledged improvement in their attendance in schools with the use of the TELA machine as it has helped teachers keep time and reduced teacher absenteeism. Despite the challenges the teachers are generally embracing the application

of TELA machine in their duty stations. The Headteachers indicate a positive influence of the TELA machine on teachers' performance as it has controlled missing of lessons by ensuring teacher availability at school by regularly and accurately tracking their attendance in person, it has also ensured the Headteachers availability at school because they will have to daily avail the machine to teachers to sign in

5.3 Conclusions

The following conclusions were made based on the findings of the study which was guided by the six questions. About the current teacher attendance system in use, it was concluded that TELA machine was the most used. However, some schools still used both the machine and the manual arrival books. The major problems encountered during the TELA machine application is rejection of some faces during logging in, network failures, lack of sufficient data and power source to run the machines, regular failures and technical glitches and inadequate knowledge on how to operate the TELA machine. Despite the challenges the teachers are eager and only suggest that area of improvements could be further training of its use, provision of technical support by way of establishing service centres with the district, increasing the availability by upscaling the use of TELA machines, and use of alternative login credentials.

It was generally concluded that the use of biometric machine has improved the teacher's performance and affected them positively as it has enabled them appreciate their weakness on time management and improved accordingly. When used effectively and with support the administrators concluded that it has had a positive influence on teacher performance as they don't again run around chasing teachers to attend to school activities, it has reduced time wastage, its safe and convenient way to store teachers' data on arrival and it can be easily retrieved without one thinking of being witch-hunted and the information disseminated is accurate and cannot be disputed.

5.1 Recommendations

The following recommendations were made to various stake holders concerning the application of biometric machines in the assessment of teacher performance in primary schools. The stakeholders are; school administrators, teachers, ministry of Education and sports. Government is recommended to put in place both machines and human resource to

enhance the application of biometric technology in the administration and evaluation of teacher performance in public schools. This could be emphasized by the Ministry of Education and mainstreamed in the national policy framework. Ministry of Education could liaise with private sector of improve on the knowledge gap on application of the biometric technology through refresher courses and capacity building and enhancing the technological functionality of the current machine and even improving on their efficiency and installation of new software, scaling up its usage to all public schools is a benefit. School administrators should mentor other staff on application and storage and retrieval of data and information from the TELA machines. This is meant to equip their staff with ICT skills, but alternatively teacher can take it upon themselves to acquire additional skills in ICT filed to counter the challenges they face in the application of biometric technology and in order to be dynamic. Since the biometric attendance system is faster, more accurate and secured, academic institutions should adopt it in lieu of the manual approach.

Suggested areas for further studies may be

1. Availability, accessibility and application of biometric machines in rural schools in Tororo.
2. Perception of teachers on the application of Biometric machine in rural public schools in Tororo.
3. Impact of the teacher's attitude of use and application of biometric machine in Tororo.
4. To role of other stake holders in application of digital technology in tracking teacher performance in Tororo.

REFERENCES

Affairs, C. (2021). *Biometric Recognition and Behavioural Detection*. *August*.

Atam, E. (2017). *The Importance and Challenges of Biometric Machine in School Supervision . A Case Study of THE IMPORTANCE AND CHALLENGES OF BIOMETRIC MACHINE IN SCHOOL SUPERVISION . A CASE STUDY OF ACCESS HIGH SCHOOL , CALABAR* .

Cvetković Vega, A., Maguiña, J. L., Soto, A., Lama-Valdivia, J., & Correa López, L. E. (2021). Cross-sectional studies. *Revista de La Facultad de Medicina Humana*, *21*(1), 164–170. https://doi.org/10.25176/rfmh.v21i1.3069

Cui, S., Ekwonnah, O., & Wang, Y. (2018, December 7). The Analysis of Emotions over Keystroke Dynamics. https://scite.ai/reports/10.12783/dtcse/iece2018/26620

Chen, N., Shen, K., & Liang, C. (2021, May 21). Hybrid Decision Model for Evaluating Blockchain Business Strategy: A Bank's Perspective. https://scite.ai/reports/10.3390/su13115809

Rukhiran, M., Wong-In, S., & Netinant, P. (2023, January 1). IoT-Based Biometric Recognition Systems in Education for Identity Verification Services: Quality Assessment Approach. https://scite.ai/reports/10.1109/access.2023.3253024

Ibrahim, M., AbdelRaouf, H., Amin, K., & Semary, N A. (2022, September 28). Keystroke dynamics based user authentication using Histogram Gradient Boosting. https://scite.ai/reports/10.21608/ijci.2022.155605.1081

Hernandez-de-Menendez, M., Escobar, C A., & Arinez, J. (2021, July 28). Biometric applications in education. https://scite.ai/reports/10.1007/s12008-021-00760-6

Farazdaghi, E., Eslahi, M., & Meouche, R E. (2021, April 15). AN OVERVIEW OF THE USE OF BIOMETRIC TECHNIQUES IN SMART CITIES. https://scite.ai/reports/10.5194/isprs-archives-xliv-2-w1-2021-41-2021

El-Ghandour, M., Obayya, M., Yousef, B., & Areed, N F F. (2021, January 1). Palmvein Recognition Using Block-Based WLD Histogram of Gabor Feature Maps and Deep Neural Network With Bayesian Optimization. https://scite.ai/reports/10.1109/access.2021.3093343

Muhtasim, D A., Pavel, M I., & Tan, S Y. (2022, August 12). A Patch-Based CNN Built on the VGG-16 Architecture for Real-Time Facial Liveness Detection. https://scite.ai/reports/10.3390/su141610024

Hazrati, M., Dara, R., & Kaur, J. (2022, June 21). On-Farm Data Security: Practical Recommendations for Securing Farm Data. https://scite.ai/reports/10.3389/fsufs.2022.884187

Kim, C., Lee, K C., & Costello, F J. (2020, June 2). The Intention of Passengers towards Repeat Use of Biometric Security for Sustainable Airport Management. https://scite.ai/reports/10.3390/su12114528

Rosário, A T., & Dias, J C. (2023, January 19). How Industry 4.0 and Sensors Can Leverage Product Design: Opportunities and Challenges. https://scite.ai/reports/10.3390/s23031165

Wambui, B M., Gikandi, J W., & Wambugu, G M. (2022, March 17). A Survey of Biometric Authentication Technologies Towards Secure And Robust Systems: A Case Study of Mount Kenya University. https://scite.ai/reports/10.5539/cis.v15n2p43

Amiribesheli, M., Benmansour, A., & Bouchachia, A. (2015, March 14). A review of smart homes in healthcare. https://scite.ai/reports/10.1007/s12652-015-0270-2

Leghari, M., Memon, S Q., Dhomeja, L D., Jalbani, A H., & Chandio, A A. (2021, February 7). Deep Feature Fusion of Fingerprint and Online Signature for Multimodal Biometrics. https://scite.ai/reports/10.3390/computers10020021

Stamatis, P J., & Chatzinikola, M. (2021, April 29). Advantages and Reasons Hindering the Communication between Teachers and Parents: An Empirical Study. https://scite.ai/reports/10.24018/ejedu.2021.2.2.79

Khaldi, A., Bouzidi, R., & Nader, F. (2023, January 31). Gamification of e-learning in higher education: a systematic literature review. https://scite.ai/reports/10.1186/s40561-023-00227-z

Harahap, M R., Silalahi, A., Muchtar, Z., & Nurfajriani, N. (2022, October 26). The Development of Lectora Inspire Learning Media and Its Effect on Student Learning Outcomes. https://scite.ai/reports/10.21580/jec.2022.4.2.11303

Yan, Q., Zhang, L J., & Dixon, H. (2022, November 14). Exploring classroom-based assessment for young EFL learners in the Chinese context: Teachers' beliefs and practices. https://scite.ai/reports/10.3389/fpsyg.2022.1051728

Information, Communication & Technology Usage and Students' Academic Performance in Public Secondary Schools in Rwanda. (2022, October 25). https://scite.ai/reports/10.53819/81018102t3058

Durukan, Ü G., Batman, D., & Aslan, A. (2022, October 13). The Analysis of Middle School Science Course Contents of Out-of-School Learning Environment Guidebooks. https://scite.ai/reports/10.14686/buefad.990199

Kaklauskas, A., Abraham, A., Ubarte, I., Kliukas, R., Luksaite, V., Binkyte-Veliene, A., Vetloviene, I., & Kaklauskiene, L. (2022, October 14). A Review of AI Cloud and Edge Sensors, Methods, and Applications for the Recognition of Emotional, Affective and Physiological States. https://scite.ai/reports/10.3390/s22207824

Ismail, N., Rahman, A M A., Rifa'i, A M A., Jamil, S M., Zakaria, N L., & Rahman, H A. (2022, July 11). A Qualitative Study of Data Management Development for Hybrid Organisation Application. https://scite.ai/reports/10.3991/ijim.v16i13.30617

Ponce-Hernandez, W., Blanco-Gonzalo, R., Liu-Jimenez, J., & Sanchez-Reillo, R. (2020, January 1). Fuzzy Vault Scheme Based on Fixed-Length Templates Applied to Dynamic Signature Verification. https://scite.ai/reports/10.1109/access.2020.2965165

Doseděl, T., Kafková, M P., & Vidovićová, L. (2023, August 2). Age and gender difference in ICT literacy and biometrics knowledge. https://scite.ai/reports/10.5817/soc2022-21291

Figueroa, C., Ayala, A F., Trejo, L A., Ramos, B., Briz, C L., Noriega, I., & Chávez, A R. (2023, February 28). Measuring the Effectiveness of a Multicomponent Program to Manage Academic Stress through a Resilience to Stress Index. https://scite.ai/reports/10.3390/s23052650

Orhan, F T., & Gursoy, H. (2023, February 2). A Proposed Method for Estimating Refractive Error in Primary School Children. https://scite.ai/reports/10.7759/cureus.34554

Biometrics (facts, use cases, biometric security) - Thales. (2023, June 12). https://www.thalesgroup.com/en/markets/digital-identity-and-security/government/inspired/biometrics

Fingerprint Access Control: Pros, Cons, & How It Works - ButterflyMX. (2022, December 16). https://butterflymx.com/blog/fingerprint-access-control/

Meshram, S. (2022, July 25). Privacy intrusion. https://scite.ai/reports/10.53730/ijhs.v6ns6.11106

Khade, S., Ahirrao, S., Phansalkar, S., Kotecha, K., Gite, S., & Thepade, S D. (2021, October 6). Iris Liveness Detection for Biometric Authentication: A Systematic Literature Review and Future Directions. https://scite.ai/reports/10.3390/inventions6040065

The perceptions of tertiary level EFL teachers and students to the tool mediation learning experience in reading skills: A case for cloud computing environment. (2023, January 1). https://scite.ai/reports/10.47750/jett.2023.14.01.035

Hofbauer, L., & Rodriguez, F S. (2022, November 1). How is the usability of commercial activity monitors perceived by older adults and by researchers? A cross-sectional evaluation of community-living individuals. https://scite.ai/reports/10.1136/bmjopen-2022-063135

Silva, M T A C A., & Parente, C. (2022, July 21). From Incubation to Sustainability: a Case-Study of Graduated Companies in Portugal. https://scite.ai/reports/10.24840/2183-0606_010.002_0001

User Acceptance Factors Related to Biometric Recognition ... - MDPI. (2023, February 8). https://www.mdpi.com/2071-1050/15/4/3092

Morgan, M A., Doku, B C., Asare, E S., Dansoah, J., Nartey, J K., & Manteaw, N. (2023, March 5). Improving Home Economics Students' Interest in Biology: The Influence of Certain Effective Teachers' Classroom Management Practices. https://scite.ai/reports/10.18535/ijsrm/v11i03.el1

Gordillo-Tenorio, W., Meléndez-Flores, C., Sierra-Liñan, F., & Cabanillas-Carbonell, M. (2023, February 23). Information Technologies that Help Improve Academic Performance, A Review of the Literature. https://scite.ai/reports/10.3991/ijet.v18i04.34821

Eegdeman, I., Cornelisz, I., Klaveren, C V., & Meeter, M. (2022, November 24). Computer or teacher: Who predicts dropout best?. https://scite.ai/reports/10.3389/feduc.2022.976922

Kim, M. (2023, February 25). Effects of a Comprehensive Person-Centered Care Education Program for Nursing Students. https://scite.ai/reports/10.3390/medicina59030463

Ma, N., Chau, J P C., Deng, Y., & Choi, K C. (2023, February 1). Effects of a structured Tai Chi program on improving physical activity levels, exercise self-efficacy and health outcomes among pregnant women: study protocol for a randomised controlled trial. https://scite.ai/reports/10.1136/bmjopen-2022-065640

Vibert, B., Bars, J L., Charrier, C., & Rosenberger, C. (2023, April 18). Comparative study of minutiae selection methods for digital fingerprints. https://scite.ai/reports/10.3389/fdata.2023.1146034

Kloet, M D., & Yang, S. (2022, August 17). The effects of anthropomorphism and multimodal biometric authentication on the user experience of voice intelligence. https://scite.ai/reports/10.3389/frai.2022.831046

Oliveira, R D D., Barbosa, M L D A., Klein, A A., Kistmann, V B., & Okimoto, M L L R. (2022, June 14). Privacidade por Definição e os aspectos de privacidade de dados pessoais no contexto do design inclusivo e de serviços. https://scite.ai/reports/10.29147/datjournal.v7i2.613

Patil, S., Raut, R., Jhaveri, R H., Ahanger, T A., Dhade, P., Kathole, A B., & Vhatkar, K N. (2022, May 2). Robust Authentication System with Privacy Preservation of Biometrics. https://scite.ai/reports/10.1155/2022/7857975

Biometrics Implementation in a Private School: A Case Study. (2023, August 30). https://www.securityinfowatch.com/access-identity/article/53069593/suprema-biometrics-implementation-in-a-private-school-a-case-study

Biometrics in Schools, Colleges & Universities: Application and Impact. (2019, October 11). https://www.m2sys.com/blog/biometric-identification/biometrics-in-schools-colleges-universities-application-and-impact/

Biometrics in Schools to Yield Security Benefits and Privacy Concerns .... (2019, May 7). https://edtechmagazine.com/k12/article/2019/05/biometrics-schools-yield-security-benefits-and-privacy-concerns

Beyond Just Ethics: The Implications Of Biometrics And Data Privacy. (2023, August 2). https://www.forbes.com/sites/forbestechcouncil/2023/08/02/beyond-just-ethics-the-implications-of-biometrics-and-data-privacy/

8 Considerations When Establishing Cybersecurity in Higher Education .... (2023, October 8). https://er.educause.edu/articles/sponsored/2023/10/8-considerations-when-establishing-cybersecurity-in-higher-education

Implications of New School Surveillance Methods on Student Data Privacy .... (2023, April 14). https://sjipl.mainelaw.maine.edu/2023/04/14/implications-of-new-school-surveillance-methods-on-student-data-privacy-national-security-electronic-surveillance-and-the-fourth-amendment/

As more biometric data is collected in schools, parents need to ask .... (2022, November 29). https://theconversation.com/as-more-biometric-data-is-collected-in-schools-parents-need-to-ask-these-10-questions-191263

Hussein, A R., & Rashid, R. (2022, December 14). KurdFace Morph Dataset Creation Using OpenCV. https://scite.ai/reports/10.25271/sjuoz.2022.10.4.943

Wu, F., Li, X., Zhao, W., & Ning, B. (2022, July 30). Gait Recognition Based on the Plantar Pressure Data of Ice and Snow Athletes. https://scite.ai/reports/10.1155/2022/2982894

Agrawal, S., Oza, P., Biswas, M., & Choksi, N. (2021, November 9). Enhanced Secure ATM authentication using NFC Technology and Iris Verification. https://scite.ai/reports/10.12694/scpe.v22i2.1920

Importance of the Biometric Integration Feature in Schools. (2023, November 6). https://proctur.com/blog/importance-of-the-biometric-integration-feature-of-the-school-erp-system-in-schools/

Yang, W., Wang, S., Yin, X., Wang, X., & Hu, J. (2022, January 1). A Review on Security Issues and Solutions of the Internet of Drones. https://scite.ai/reports/10.1109/ojcs.2022.3183003

Guirou, N., Dembélé, Y., Napo, A., Japhet, T., Coulibaly, D., Dougnon, A., Tall, A., & Sylla, F. (2021, August 31). Effect Of Trabeculectomy On Ocular Biometry And Refractive Errors In Pediatric Glaucoma. https://scite.ai/reports/10.19044/esj.2021.v17n29p291

AL-Ghamdi, A S A., & Ragab, M. (2022, January 1). Artificial Intelligence Techniques Based Learner Authentication in Cybersecurity Higher Education Institutions. https://scite.ai/reports/10.32604/cmc.2022.026457

Shahbakhsh, M B., & Hassanpour, H. (2022, January 1). Empowering Face Recognition Methods using a GAN-based Single Image Super-Resolution Network. https://scite.ai/reports/10.5829/ije.2022.35.10a.05

How School Management Software Simplifies Administrative Tasks. (2023, August 7). https://medium.com/@classonapp/how-school-management-software-simplifies-administrative-tasks-d53f43f19fbb

Kiral, E., & ÖZTABAN, A. (2022, November 1). Fulfilment Levels of School Administrators' Technology Leadership Roles. https://scite.ai/reports/10.21666/muefd.1072650

Wang, X. (2022, August 8). An Overview of ICT and Educational Change: Development, Impacts, and Factors. https://scite.ai/reports/10.26689/jcer.v6i8.4191

Affairs, C. (2021). *Biometric Recognition and Behavioural Detection*. *August*.

Atam, E. (2017). *The Importance and Challenges of Biometric Machine in School Supervision . A Case Study of THE IMPORTANCE AND CHALLENGES OF BIOMETRIC MACHINE IN SCHOOL SUPERVISION . A CASE STUDY OF ACCESS HIGH SCHOOL , CALABAR* .

Fairhurst, M., Li, C., & Da Costa-Abreu, M. (2017). Predictive biometrics: A review and analysis of predicting personal characteristics from biometric data. *IET Biometrics*, *6*(6), 369–378. https://doi.org/10.1049/iet-bmt.2016.0169

Fingerprints & Feet. (2019). *July*.

Hernandez-de-Menendez, M., Morales-Menendez, R., Escobar, C. A., & Arinez, J. (2021). Biometric applications in education. *International Journal on Interactive Design and Manufacturing*, *15*(2–3), 365–380. https://doi.org/10.1007/s12008-021-00760-6

Hoo, S. C., & Ibrahim, H. (2019). Biometric-based attendance tracking system for education sectors: A literature survey on hardware requirements. *Journal of Sensors*, *2019*. https://doi.org/10.1155/2019/7410478

IDENTIFICATION IN HIGHER INSTITUTIONS OF LEARNING USING BIOMETRIC. (2019).

office of information technology service, N. york. (2023). *Use of Biometric Identifying Technology in Schools*.

Salome, W. (2019). *University of Nairobi School of Computing and Informatics Biometrics Class Attendance Management System*.

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, *22*(2), 63–75. https://doi.org/10.3233/EFI-2004-22201

Study, A. C. (2020). *Adoption of Biometric System to Manage Teachers Absenteeism for Improvement of Teachers Performance : 10*(5), 434–445. https://doi.org/10.29322/IJSRP.10.05.2020.p10150

Wandera, S. O., Kwagala, B., Nankinga, O., Ndugga, P., Kabagenyi, A., Adamou, B., & Kachero, B. (2019). Facilitators, best practices and barriers to integrating family planning data in Uganda's health management information system. *BMC Health Services Research*, *19*(1), 1–13. https://doi.org/10.1186/s12913-019-4151-9

APPENDICES

Appendix 1: QUESTIONNAIRE

Dear teacher , I am OMALLA JOSEPHINE, a student of Busitema University carrying out a research on the topic, influence of application of Biometric machine on teacher performance in selected primary schools in Eastern Division ,Tororo District and I request you to fill in the questionnaire. The researcher will not record names and other personal details thus feel free to contribute with all honesty. I request for truth and faithful response and promise to handle the results with confidential and will be used for this purpose only and results will be aggregated.

Section A: demographic characteristics

Please tick the appropriate box

Age in years

(i) Less than or equal to 25 ☐ (ii) 26-35 ☐ (iii) 36-45 ☐ (iv) 45 and above ☐

Gender

(i) Male ☐ (ii) Female ☐

Education level

(i) Grade III ☐ (ii) Diploma ☐ (iii) Degree ☐

Length of stay at school

(i) Less than 5 yrs ☐ (ii) 6-10 yrs ☐ (iii) 11-15 years ☐

(iv) 16 yrs and above ☐

Experience in years

(i) 1-10 yrs ☐ (ii) 11-20yrs ☐ (iii) 21^{+}yrs ☐

Section B

Please provide response on what best suits your opinion on the influence of application of Biometric machine on teacher performance in selected primary schools in Eastern Division in Tororo.

Variable Dimension	**Response from the teachers**
What is the current teacher attendance system in use	
What are the challenges you encounter with the current teacher attendance system in use in your school	
What do you think are the possible ways to solve and improve the above challenges	
In your opinion what areas do you think needs improvements in the current teacher attendance in your school	
How has the new system of attendance improved on your performance at school	
Are there any other comments on the current teacher system which I did not ask that you think is essential to the study topic	

Appendix 2: BUDGET

Item	Expected expenditure
Stationary	100,000=
Printing	100,000=
Airtime and data	30,000=
Transport	200,000=
Field assistants	100,000=
Markers	20,000=
Miscellaneous	100,000=
Total	**650,000=**

Appendix 3: Work plan

Out put	Activities	Time frame
Proposal writing	Signing and content of the contract	Oct.
	Topic analysis	Oct.
	Chapter compilation	Oct.
	Proposal defence	Oct.
	Weekly meetings	Every Friday.
Data collection	Consultation with the Division and schools	Dec.
	Administering questionnaires to schools	Late-Dec.
	Data sharing with supervisor and compilation	Early- Mid Jan.
	Data analysis	Late Jan.
Dissertation	Report writing	Late Jan.
	Dissertation defence	Feb.

BUSITEMA UNIVERSITY
Pursuing Excellence

P.O.Box 236, Tororo
Gen:+256-454448842
Dir: +256-454448864
Mob: +256-782999874
Fax: +256-454436517
Email:ar@acadreg.busitema.ac.ug
Website:www.busitema.ac.ug

FACULTY OF SCIENCE AND EDUCATION
DEPARTMENT OF EDUCATION

20th September, 2023

TO WHOM IT MAY CONCERN

BACHELOR OF EDUCATION, PRIMARY

MR/Ms. OMANYA JOSEPHINE ..... is a student of Bachelor of Education, Primary of Busitema University, Faculty of Science and Education, Nagongera Campus. His/her Registration Number is. BU/UP/2020/2909 .....

The purpose of this letter is to formally request you to allow him/her to access any information in your organisation which is relevant to his/her research.

His/her research topic is. INFLUENCE OF APPLICATION OF BIOMETRIC MACHINES ON TEACHER PERFORMANCE IN TEACHING IN SELECTED PRIMARY SCHOOLS IN EASTERN DIVISION INTORO

Yours Sincerely,

BUSITEMA UNIVERSITY
DEPARTMENT OF EDUCATION
FACULTY OF SCIENCE AND EDUCATION
22 SEP 2023
NAGONGERA CAMPUS
P.O BOX 236,TORORO (U)

Dr Kaweesi Muhamadi
Ag Head of Department, Education