

**IMPACT OF ELECTRONIC SECURITY SURVEILLANCE SYSTEMS ON
SAFETY MEASURES IN SECONDARY SCHOOL IN TRANS NZOIA COUNTY,
KENYA**

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**A Thesis Submitted in Partial Fulfilment for the Degree of Master of Science in
Disaster Management and Sustainable Development of Masinde Muliro University of
Science and Technology**

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DECLARATION

This thesis is my original work prepared by no other than the indicated sources and support and has not been presented elsewhere for a degree or nay other award.

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DEDICATION

I dedicate this thesis to my dear sons – Emmanuel Rono, Edmond Rono and Caleb Rono for the moral support I have enjoyed from you sons.

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ABSTRACT

The safety of secondary schools is critical for ensuring consistent academic performance. However, schools worldwide face various threats that undermine this safety. In Kenya, secondary schools have experienced several security challenges, including fires, theft, and radicalization. Despite these risks, the adoption of electronic security surveillance systems to mitigate such threats remains limited. In Trans Nzoia County, secondary schools are particularly vulnerable to security threats, placing the school community at significant risk. Against this backdrop, this study aimed to assess the impact of electronic security surveillance systems on secondary school safety in Trans Nzoia County, Kenya. The specific objectives of the study were to examine the nature and extent of electronic security surveillance systems in secondary schools, evaluate their effectiveness in enhancing safety, and explore the challenges hindering their optimal operation. The Situational Crime Prevention Theory and Contingency Theory guided the research. A descriptive survey research design was employed, targeting 14 secondary schools that had previously encountered security threats and had installed electronic surveillance systems. Simple random sampling and purposive sampling were used to select participants, including school principals (14), boarding teachers (14), security personnel (14), students (70—10 from each of the 7 schools), the County Director of Education (1), and the Chief Fire Officer (1). Data collection methods included structured questionnaires, interview guides, focus group discussions, and observation checklists. Quantitative data were analyzed using descriptive and inferential statistics with the assistance of SPSS version 25, with a significance level set at 0.05. Results were presented using tables and figures, with percentages and frequencies. Qualitative data were analyzed thematically and presented verbatim. The study found that CCTV cameras had been installed in all the surveyed secondary schools. The majority of respondents (76.9%) agreed that the presence and extent of electronic security surveillance systems contributed to enhancing safety within the school community. The interaction between installed surveillance systems, national ICT policy, and school safety policy explained 29.9% of the variance in the promotion of school safety ($R^2 = 0.299$, $F(2, 75) = 15.966$, $p = 0.000$). Additionally, 80.8% of respondents confirmed the effectiveness of electronic surveillance systems in improving school safety. There was a 40.9% variance in the effectiveness of these systems on school safety when national ICT and school safety policies were implemented ($R^2 = 0.409$, $F(2, 75) = 26.003$, $p = 0.000$). However, 73.1% of respondents reported challenges in the optimal operation of these systems, which were significantly associated with the implementation of national ICT and school safety policies, contributing to a 32.3% impact on school safety ($R^2 = 0.323$, $F(2, 75) = 17.861$, $p = 0.000$). The study concluded that CCTV cameras are the most preferred form of electronic security surveillance in secondary schools. However, challenges in their operation hinder their full potential in maintaining school safety. Consequently, the study recommends that the boards of management in secondary schools, in collaboration with the Ministry of Education and the Ministry of ICT, expand the use of additional surveillance technologies, such as fire alarms, burglary alarms, metal detectors, and biometric systems, to enhance the safety of the school community. Increased investment in electronic security systems is essential to cover the entire school precinct and to support the personnel responsible for reporting security threats.

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ABBREVIATIONS AND ACRONYMS

CCTV	Closed Circuit Television
CIDP	County Integrated Development Plan
DMSD	Disaster Management and Sustainable Development
DPS	Directorate of Postgraduate Studies
ESSS	Electronic Security Surveillance System
EVM	Electronic Visitors Management
FGD	Focus Group Discussion
ICT	Information and Communication Technology
MMUST	Masinde Muliro University of Science and Technology
NACOSTI	National commission of Science, Technology and Innovation
NCES	National Center for Education Statistics
SCP	Situational crime prevention
SDGs	Sustainable Development Goals
SDMHA	School of Disaster Management and Humanitarian Assistance
UK	United Kingdom
USA	United States of America

OPERATIONALIZATION OF TERMS

Biometric machines: Devices that use biological characteristics (such as fingerprints, facial recognition, or iris scans) to verify the identity of individuals entering or accessing specific areas within the school premises.

Biometric technologies: Advanced technological systems that use unique biological traits, such as fingerprints, facial features, iris patterns, or voice recognition, to identify and authenticate individuals for access control and security purposes within the school environment.

Closed Circuit Television (CCTV): A surveillance system comprising video cameras installed in and around school premises, transmitting signals to specific monitors for real-time monitoring and recording of activities, to enhance security and deter potential threats.

Cyber- Security Threats: Any potential or actual malicious activities or events that compromise the integrity, confidentiality, or availability of the school's digital systems, networks, or data, including hacking, unauthorized access, data breaches, and malware attacks.

Electronic Security Surveillance Systems (ESSS): Electronic devices such as CCTV cameras, security alarms, metal detectors, electronic visitor management systems, and biometric systems installed in secondary schools to monitor, detect and record activities within a specific area to enhance security.

Electronic security system is the use of computer software and electronic devices to carry out a host of security functions to enhance the protection of a designated area.

Internal threats: Security risks or harmful activities that originate from within the school community, including students, staff, or other insiders, which can compromise the safety and security of the school environment.

Examples include vandalism, bullying, theft by insiders, and unauthorized access by students or staff.

External Threats: Security risks or harmful activities originating from outside the school community, including unauthorized individuals, criminal activities, or environmental hazards that pose a threat to the safety of the school. Examples include break-ins, external violence, natural disasters, and cyber-attacks from external sources.

Safety standards are set out as requirements that must be met to ensure the protection of learners and the learning environments, both now and in the future.

Safety threats: Any potential or actual events, actions, or conditions that compromise the physical well-being, security, or psychological safety of students, staff, and property within the school environment. These threats can be both intentional, such as violence or theft, and unintentional, such as accidents or environmental hazards.

Safety: the condition of being protected from or unlikely to cause danger, risk or injury within the school environment. This includes protection from violence, bullying, exposure to harmful substances and other threats.

School safety policy: A formal set of guidelines, procedures, and practices established by the school administration to ensure the safety and well-being of students, staff, and property. This includes protocols for emergency response, security measures, health and safety regulations, and strategies for preventing and addressing various safety threats.

School safety refers to the provision of school environments and school-related activities that ensure learners and teachers are safe from any danger or risk.

School security: Measures and protocols put in place to protect students, staff and property within the school premises. This includes physical security measures, electronic surveillance and safety policies.

Secondary school, also known as high school, refers to the educational institution that provides education to students in the stage between primary school and higher education.

Security Surveillance system is the use of security cameras to monitor and record activity in a specific area or location for security, safety or monitoring purposes. Security cameras capture live footage, which can be viewed in real-time or recorded for later review.

Surveillance: The systematic monitoring and observation of school premises and activities through technological means, such as closed-circuit television (CCTV) cameras, biometric systems, and other electronic monitoring tools, to detect, deter, and respond to potential security threats and safety issues.

Sustainability: The ability to maintain and support the effective operation of electronic security surveillance systems over time. This includes ensuring continuous functionality, regular maintenance, and adaptation to emerging security challenges.

CHAPTER ONE

INTRODUCTION

1.1. Introduction

This chapter deals with the background of the influence of electronic security surveillance systems on the sustainability of secondary schools' safety in secondary schools. The background looked at the global level, regional level and local levels. This background identifies the research gaps that led to the drafting of the statement of the problem and drew research objectives. Furthermore, this chapter identified research questions, the justification of the study and the scope of the study.

1.2. Background to the Study

School security refers to the measures put in place to safeguard individuals and property within educational settings from various threats (Goodwin, 2016). According to other sources, school safety or security is defined as the protection of students from violence, bullying, and exposure to harmful elements such as drugs, fire hazards, and gang activity (Safe Supportive Learning, 2018). Like other institutions, schools face risks from both external and internal sources due to the high number of potential assailants and vulnerable individuals who may be harmed or cause harm to others. Such threats can significantly disrupt the school environment and its academic activities.

Globally, schools are experiencing increased security lapses that expose them to internal and external threats, including arson and terrorism (Hussain, 2016). This rise in security incidents has prompted the widespread installation of closed-circuit television (CCTV)

systems to monitor students' movements and enhance security (Birnhack *et al.*, 2018). Electronic visitor management (EVM) systems and devices like EasyLobby™ have also been implemented to provide both physical and virtual safety, protecting students and teachers from security threats (Leaton-Gray, 2018). Electronic security surveillance systems have been developed to address rising criminal activities within schools (Kamal, 2024), and CCTV systems have proven effective in monitoring student movement for potential risks, thus supporting safety measures (Zhang *et al.*, 2019).

In the U.S., CCTV surveillance cameras have become a key security strategy to combat school violence and crime (Fisher *et al.*, 2021). Reports from the 2013-2014 school year indicate that 93% of public schools locked or monitored doors to control access, while 74% of education-related threats occurred in middle schools, junior high schools, and high schools (NCES, 2018). According to Fisher *et al.* (2021), school-based security is perceived to be most effectively managed through security cameras, which have been used since the late 1990s to prevent and detect school crime.

In the UK, the installation of CCTV surveillance cameras in schools can be traced to two violent incidents: the murder of head teacher Philip Lawrence and the massacre of 16 people at Dunblane Primary School in 1996 (Norris & Armstrong, 1999). In response to these events, the UK government provided funding for over 100 schools to install CCTV systems to address growing security concerns (Norris & Armstrong, 1999).

In recent years, both private and public schools in urban areas of Nepal have increasingly installed CCTV surveillance cameras in classrooms, libraries, canteens, hallways, and playgrounds to monitor school activities (Rauniyar, 2019). However, this has led to a hyper-surveillance environment, where school activities are closely scrutinized, often raising concerns about privacy and discipline.

In Africa, schools have faced rising threats such as theft and student abductions. Nweke and Nwikina (2022) report that secondary schools often lack adequate safety measures to protect students and teachers from security threats. Electronic security surveillance systems have been implemented in schools to enhance security (Hope, 2015; Stoycheff, 2016). These systems, widely used in cities, airports, and malls, have improved transparency and reduced security risks (Omolara *et al.*, 2022). However, schools in Sub-Saharan Africa, including Kenya, have been plagued by challenges such as arson and violent extremism (Mudege *et al.*, 2008). The installation of CCTV cameras and other surveillance devices is seen as a proactive approach to controlling and mitigating threats (Hove *et al.*, 2013), although incidents like arson have continued to overwhelm safety efforts (National Crime Research Centre, 2016).

Many secondary schools in Kenya, particularly in Trans Nzoia County, have struggled with security due to a lack of fencing and modern surveillance systems, such as CCTV cameras and alarms (Alunga & Maiyo, 2019). This has led to non-compliance with safety standards. Electronic security surveillance systems have the potential to build confidence among school stakeholders, including administrators, students, teachers, and support staff, by

ensuring their safety (Basimanyane & Gandhi, 2019). Without such systems, schools have often relied on reactive approaches to address security threats like arson, theft, and terrorism (Ekpoh *et al.*, 2020).

Security concerns in Kenyan schools have escalated due to unruly students, leading to the adoption of electronic surveillance systems as an alternative to physical security guards (Agutu & Mutimba, 2016; Gathii, 2018). The 2015 terrorist attack at Garissa University, which resulted in 148 deaths, highlighted the need for improved security infrastructure in educational institutions (Odhiambo *et al.*, 2015). The absence of electronic surveillance in many schools has exacerbated unsafe conditions for students and staff (Ronoh, 2018). Furthermore, visitors to school premises are rarely screened using electronic surveillance systems, leaving schools vulnerable (Gitonga, 2020). A lack of investment by school administrations in repairing or upgrading existing surveillance systems undermines their effectiveness and may contribute to the radicalization of students and staff (Mosiori, 2021). The integration of biometric technologies and CCTV for managing security threats, including terrorism, represents a significant initiative by the Ministry of Education and the Ministry of Internal Security and National Coordination (Khalif, 2020).

Schools in Trans Nzoia County have experienced a series of arson attacks, often attributed to student indiscipline, substance abuse, and peer pressure (Akoko, 2017). Historically, schools have relied on physical security guards to enhance safety, but this approach has proven inadequate. Many schools lack sufficient electronic surveillance systems, which puts students, teachers, and facilities at risk. The Kenya Data Protection Act (2019)

mandates the protection of individuals, including students and teachers, while the government's safety standards manual ensures the security of schoolchildren (Government of Kenya, 2008). This study aims to assess the impact of electronic security surveillance systems on the sustainability of safety measures in secondary schools in Trans Nzoia County, Kenya.

1.3. Statement of the Problem

Global safety in educational institutions has increasingly been compromised, disrupting the proper functioning of school systems. In 2015, the United Nations General Assembly adopted the Post-2015 Agenda, which includes the 17 Sustainable Development Goals (SDGs). Among these, SDG 4 emphasizes ensuring inclusive and quality education for all, while promoting lifelong learning. Achieving this goal requires not only enrolling all children in school but also ensuring that schools function in a manner that prioritizes the well-being of the students. This involves creating safe and protective learning environments, staffed with adequately trained teachers, equipped with sufficient resources, and meeting necessary safety standards. However, schools face both internal and external security threats, which negatively affect their ability to sustain optimal performance.

In Kenya, secondary schools have experienced security challenges, including arson, terrorism, theft, and radicalization into violent extremism. These institutions have increasingly become targets for insecurity, with incidents such as burglary, arson, and terror attacks becoming prevalent. Traditionally, security personnel have been stationed at school gates but have lacked electronic surveillance systems capable of detecting potential threats, including lethal weapons that could endanger the school community and its

facilities. Ensuring effective security measures is critical for maintaining continuity in education and promoting academic performance. Trans Nzoia County, in particular, has recorded numerous fire incidents in schools. These security concerns—ranging from fires and bullying to attacks and theft—motivated this study, which seeks to assess the impact of electronic security surveillance systems on secondary school safety in Trans Nzoia County, Kenya.

1.4. Research Objectives

1.4.1. Overall Objective

The overall objective of the study was to assess the impact of electronic security surveillance systems on secondary school safety in Trans Nzoia County, Kenya.

1.4.2. Specific Objectives

This research was guided by three specific objectives;

- i. To determine the nature and extent of electronic security surveillance systems on secondary school safety in Trans Nzoia County
- ii. To assess the effectiveness of electronic security surveillance systems on secondary school safety in Trans Nzoia County
- iii. To explore challenges in the optimal operation of electronic security surveillance systems on secondary school safety in Tran Nzoia County.

1.5. Research Questions

- i. What is the nature and extent of electronic security surveillance systems on secondary school safety in Trans Nzoia County?
- ii. What is the effectiveness of electronic security surveillance systems on secondary school safety in Trans Nzoia County?
- iii. What are the challenges in the optimal operation of electronic security surveillance systems on secondary school safety in Tran Nzoia County?

1.6. Significance of the study

1.6.1. Academic Significance

This study contributes to the existing body of knowledge on school safety and security by providing a foundation for future research. By identifying both effective strategies and potential challenges in the implementation of electronic security surveillance systems (ESSS), it aims to promote safer learning environments, which are essential for the academic success and well-being of students and staff.

The safety and security of students, teachers, support staff, and school facilities are critical in maintaining a conducive educational environment. The installation of ESSS in school compounds is a crucial measure to ensure the protection of the school community. Therefore, understanding the impact of these systems on the safety of secondary schools is central to creating a secure environment for all stakeholders. For ESSS to be effective, they must be in good working condition and properly maintained to enhance security within school premises.

This study sought to determine whether ESSS contribute significantly to the safety of students, teachers, support staff, and school facilities. Additionally, the findings aim to identify the challenges secondary schools face in the installation and management of these systems. The results of this study will provide baseline data for further research on the utilization of ESSS in secondary schools across Kenya, to improve the overall safety infrastructure within educational institutions.

1.6.2. Policy Significance

The study contributes significantly to the safety and security management of secondary schools in Trans Nzoia County and beyond. It provides valuable insights into the current state of security in schools and the extent to which electronic security surveillance systems are utilized. Additionally, the study assessed the effectiveness of these systems in enhancing school safety and identified challenges faced in their implementation. In addition, the implications of this research extend beyond Trans Nzoia County, potentially influencing national policies and serving as a model for other regions facing similar security challenges in educational institutions.

Moreover, the findings of this study contribute to enrich Information Communication Technology policy in education that hence informed secondary schools and the Ministry of Education. Furthermore, it brought out the importance of having an ICT cybersecurity policy, especially for the networked electronic security surveillance systems from potential external and remote attacks on schools. Finally, the findings were useful for understanding the main causes of security lapses and endeavour to provide long-lasting solutions against potential threats in schools in Trans Nzoia County.

1.7. Scope of the Study

This study was conducted in Trans Nzoia County, focusing on secondary schools that had experienced security threats and responded by installing electronic security surveillance systems (ESSS). Both day and boarding secondary schools were examined to address the research questions. The study spanned five sub-counties in Trans Nzoia County: Kiminini, Kwanza, Saboti, Trans Nzoia East, and Endebess. The research covered the period from 2013 to 2023, with data collection taking place between January and July 2023. The target population consisted of secondary schools with a history of security threats and functioning ESSS. The secondary schools sampled served as the units of analysis. The stakeholders in this study included; school principals, teachers, students, security personnel, the County Director of Education, and the Chief Fire Officer.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

Reviewed literature in this study focused on electronic security surveillance systems in schools as a sustainability and safety measure for students, teachers and facilities. Thus, looked at the nature and extent of electronic security surveillance systems, the effectiveness of electronic security surveillance systems on secondary school safety and the challenges in optimal operation of electronic security surveillance systems on secondary school safety.

2.2. Historical Evolution of Electronic Surveillance Systems

The concept of electronic surveillance began with the development of CCTV systems in the early 1940s. The earliest documented use of CCTV was in Germany in 1942 when engineer Walter Bruch installed a system to monitor the launch of V-2 rockets (Kroener, 2016). These early systems were analogue, meaning they relied on traditional broadcasting technology and required direct connections between the cameras and monitors, limiting their range and application. In the post-war period, CCTV technology began to be adopted in industrial settings, particularly in factories and nuclear power plants where monitoring dangerous areas from a distance was necessary. For example, in the 1950s, CCTV systems were employed in the United States to monitor production processes in factories, ensuring both safety and efficiency (Kroener, 2016). These early systems were relatively simple, with black-and-white video feeds and no recording capabilities, making them useful primarily for real-time observation (Hempel, & Töpfer, 2004).

The use of CCTV systems expanded beyond industrial settings in the 1960s and 1970s, as governments and law enforcement agencies recognized their potential for enhancing public safety (Williams, 2003). In 1968, the first major installation of CCTV cameras in public spaces occurred in Olean, New York, where they were used to monitor the downtown area in an effort to reduce crime. This marked the beginning of the widespread adoption of surveillance in public spaces. Throughout the 1970s and 1980s, CCTV systems became increasingly common in cities around the world, especially in the United States and the United Kingdom. These systems remained analogue, with video feeds transmitted over coaxial cables to monitoring stations. While they were effective in deterring crime in some cases, the limitations of analogue technology—such as poor image quality and the inability to store video footage for long periods—posed significant challenges (Lauritsen, & Feuerbach, 2015).

In the UK, for example, the use of CCTV expanded significantly in the 1980s, particularly in response to concerns about terrorism and public disorder. The installation of cameras in public areas such as shopping centres, stadiums, and transportation hubs was seen as a way to deter criminal activity and provide evidence in the event of an incident. However, the effectiveness of these early systems was often questioned due to the low resolution of the images and the difficulty of identifying individuals from the footage (Gras, 2004).

2.3. Nature and Extent of Electronic Security Surveillance Systems on Secondary School Safety

Owing to insecurities – crime and threats – in schools, the deployment of electronic security surveillance systems (CCTV, metal detectors, alarm systems, fingerprints and facial recognition have been implemented at the point of entry into schools (Taylor, 2013). In Israel, secondary school principals started installing CCTVs to promote the security of the students, teachers and facilities (Perry-Hazan & Birnhack, 2016). However, students find application for CCTVs in school a conflicting balance between a violation of their privacy and the enhancement of their safety (Birnhack & Perry-Hazan, 2020).

Sub-Saharan Africa has been affected by a series of insecurities and threats in schools' students, teachers or visitors seeking to cause harm (Adams, 2016). Electronic security surveillance systems (CCTVs, alarms, and metal detectors) help monitor and identify potential threats to the school community and prosecute them (James & Saraso, 2016). Investment in CCTVs and other electronic security surveillance devices comes in handy as a proactive avenue for controlling and mitigating threats to students, teachers, support staff and the facilities in schools (Khalif, 2020). Electronic security surveillance systems enhance confidence in the school administration, students, teachers and support staff that their security is ensured. There have been grave challenges regarding school, arson attacks that have been overwhelming the schools to enhance safety occurrences (National Crime Research Centre, 2016). Threats – arson, theft and terrorism – in schools have been relying on the reactive approach because of the lack of or inadequacy of electronic security surveillance systems (Ekpoh *et al.*, 2020). Alunga & Maiyo (2019) observed that most

secondary schools were not well-fenced and thus rarely installed modern surveillance systems such as CCTVs, and alarms and were not compliant.

Additionally, Dairo (2020) conducted a study on the relationship between safety awareness, equipment availability, and school infrastructure in relation to public secondary school security in Oyo State, Nigeria. The study found that students reported various security threats, including rape (23.2%), bullying (44.6%), and kidnapping (1.0%). Significant positive correlations were observed between public secondary school security and safety awareness ($r=0.39$), school infrastructure ($r=0.28$), and equipment availability ($r=0.27$). Collectively, these factors contributed to public secondary school security ($F(3,646) = 95.44$, $\text{Adj } R^2 = 0.37$), accounting for 37.0% of the variance in school security. The study also found that school infrastructure ($\beta = 0.47$), safety awareness ($\beta = 0.25$), and equipment availability ($\beta = 0.03$) had significant relative contributions to school security. The findings suggest that enhancing safety awareness, school infrastructure, and equipment availability would improve security in public secondary schools in Oyo State.

2.3.1 Electronic Security Surveillance Systems and safety

Electronic security surveillance systems are crucial in providing the capabilities that enhance the protection of people and property (Räty, 2010; Silva, 2019). According to previous studies, electronic security surveillance systems serve as a security force multiplier in a wide area complementing physical security personnel (Fotouhi *et al.* 2019). CCTV for instance supports comprehensive coverage with the use of video that gives the location and time of an incident.

Electronic security technologies have evolved as an essential safety consideration against terrorism, theft, bullying and arson (Ewton, 2014; Kappeler & Potter, 2017). From previous studies, it is known that CCTVs, alarms, and metal detectors do not actively stop the threat but help the school administration monitor and report incidents (Hope, 2015; James & Saraso, 2016). Electronic security surveillance technologies are critical in the modern world that is under many threats such as terrorism, violent extremism, civil unrest, cyber-attacks and bullying (Nasser-Eddine *et al.*, 2011; Kenney, 2015). Schools globally have been taken as fertile ground where threats are propagated (McCann, 2014). Striking and riots are common in schools and institutions of higher learning, thus, CCTVs become critical in monitoring the activities reporting on the extent of damage and capturing the culprits at a particular site (Thomas, 2020).

Therefore, an electronic security surveillance system was designed to enhance the monitoring of potential threats and provide immediate information for action (Lee & Lee, 2015). Early identification of threats is given priority by the school administration for the safety of the students, teachers, supporting staff and facilities. Electronic security surveillance systems are easily affected by human activities during rioters' activities (Wang, 2013). The study established that most schools had not complied with the Ministry of Education safety standards, majority of the teachers, students and staff were not trained and aware of the safety measures (Rahman, 2017). Hope (2009), in a study on school surveillance and social control, found that while CCTV technology, which primarily targets students, is effective for direct observation, it does little to encourage long-term self-surveillance among students. The study concluded that the use of CCTV in schools

signifies a shift in values, moving away from social control through cultural integration and towards a more system-driven approach. This shift carries significant ethical implications. Johnson *et al.* (2018), in their study titled Surveillance or Safekeeping? How School Security Officers and Camera Presence Influence Students' Perceptions of Safety, Equity, and Support, found that the use of security cameras inside schools was linked to lower perceptions of safety, equity, and support among students. However, moderate use of security cameras outside the school was associated with higher student perceptions of support. The presence of security officers was generally connected to higher perceptions of safety. Notably, for Black students, the presence of cameras was associated with increased perceptions of safety and support compared to white students.

Ghimire and Rana (2023) conducted a study on the perceived value of CCTV surveillance in schools, revealing that the primary purpose of these cameras was to control non-compliant behaviours among students and teachers to enhance academic performance. While the study examined how schools leveraged this technology for their benefit, it also highlighted that CCTV surveillance is vulnerable to misuse and could lead to the victimization of children, particularly in the absence of adequate legal regulations.

Udali (2020), in a study on students' and staff's awareness of school safety measures in public boarding secondary schools in Trans-Nzoia County, Kenya, found that neither students nor staff were trained on safety requirements according to the Ministry of Education's Safety Manual, leading to a lack of awareness of the necessary safety measures. The study recommended that students, teachers, and other stakeholders be sensitized to

safety rules. It also emphasized that school principals should ensure all students and staff receive proper training on safety measures to prevent security issues in boarding schools. Gbesoevi *et al.* (2022), in their study on safety and security planning and the effective management of public secondary schools in Lagos State, Nigeria, found several significant relationships. The study revealed a significant correlation between school security planning and the effective management of public secondary schools ($r = .378, p < .05$). It also found a significant relationship between school safety programs and effective management ($r = .532, p < .05$), as well as between the school's social environment safety and effective management ($r = .452, p < .05$). Additionally, a significant relationship was observed between physical security measures and the effective management of public secondary schools in Lagos State ($r = .672, p < .05$). The study concluded that safety and security planning significantly promote the effective management of public secondary schools in Lagos State, Nigeria.

2.3.2 Biometric surveillance system and safety

The concept of biometric identification dates back to the 19th century when Alphonse Bertillon developed a system for identifying criminals based on anthropometric measurements (Cole, 2009). This system, known as Bertillonage, involved the measurement of various physical characteristics, such as the length of the head, the width of the cheeks, and the length of the fingers. While Bertillonage was eventually replaced by fingerprint analysis, it laid the groundwork for the development of biometric systems. Fingerprint analysis became the first widely adopted biometric system, particularly in law enforcement. The introduction of the Henry Classification System in the early 20th century allowed for the systematic cataloguing and retrieval of fingerprint records, making it easier

for police to identify suspects (Cole, 2009). Over the years, fingerprint analysis has remained a cornerstone of biometric identification, with modern systems employing automated fingerprint identification systems (AFIS) to match prints against large databases (Gelb & Clark, 2013).

The latter half of the 20th century saw significant advancements in biometric technologies, particularly with the advent of computing and digital imaging (Jain *et al.*, 2016). These developments enabled the creation of more sophisticated biometric systems, including facial recognition, iris recognition, and voice recognition (Gates, 2011). Each of these technologies has its unique advantages and challenges, which have been the subject of extensive research.

Facial recognition technology, for instance, has evolved from simple 2D image analysis to complex 3D modelling and deep learning algorithms (Zhao *et al.*, 2003). These advancements have improved the accuracy and reliability of facial recognition systems, making them suitable for a wide range of applications, from security and surveillance to unlocking smartphones and verifying identities at border control.

Iris recognition, another prominent biometric technology, is known for its high accuracy and resistance to spoofing. This technology analyzes the unique patterns in the iris of the eye, which remain stable over a person's lifetime (Jain & Kumar, 2010).). Iris recognition systems have been deployed in various high-security environments, including airports and government facilities, where accurate and reliable identification is critical.

Voice recognition, on the other hand, leverages the unique vocal characteristics of individuals to identify them. This technology is particularly useful in scenarios where other biometric modalities may not be feasible, such as over the phone or in noisy environments (Prasad, 2015). Voice recognition systems have been used in various applications, including access control, banking, and customer service.

Jaiswal and Tarar (2020) highlight that biometric security systems have numerous real-life applications, including crime control, terrorist alerts, smart societies, airport security, university campuses, and the surveillance of public spaces. In recent years, there has been a growing interest in individual security, leading to the widespread deployment of surveillance cameras globally. This trend has drawn greater attention from the scientific community toward automated surveillance systems. Alongside this, biometrics research has gained popularity, driven by the development of new approaches to address specific challenges in unconstrained environments. However, despite these advancements, no automated surveillance system capable of reliable biometric recognition in such settings has yet become available (Neves *et al.*, 2016).

Muftron and Wei (2024) discussed the application of biometric technology in school attendance and security management, highlighting its emergence as a trend for enhancing security and streamlining attendance recording, effectively replacing manual systems that are susceptible to errors and fraud. Their research specifically evaluated how biometric technology can minimize cheating, improve the accuracy of attendance records, and bolster

school security. Employing quantitative methods and a case study approach across five schools that had implemented biometric systems, the study revealed that the use of biometric technology significantly improved the efficiency and accuracy of attendance tracking. Student attendance was recorded swiftly and accurately, with cheating virtually eliminated. Additionally, the technology-enhanced school security by ensuring that only verified individuals could access the facilities (Muftron & Wei, 2024).

Ebsary (2018) notes that in response to the increase in school shootings across the United States, school administrators, faculty, parents, and students have become increasingly concerned about the security of individuals entering and exiting school grounds. Facial recognition has become a widely adopted biometric technology for enhancing campus security and safety. Unlike other biometric systems, facial recognition does not require individuals to be in direct contact with or close to sensors, making it particularly effective for identifying people on school campuses. However, the effectiveness of facial recognition systems largely depends on students' cooperation and their attitudes toward this technology. The study found that while facial recognition has potential benefits, it also raises concerns among students about their informational privacy, particularly regarding how the system is operated, administered, and managed by the school's faculty and staff (Ebsary, 2018).

2.4. Effectiveness of Electronic Security Surveillance Systems on Secondary School Safety

Crime and safety threats in the United States of America (USA), Colorado State saw two students armed with guns in 1999, attack the school community and claim fifteen lives and kill themselves after the act (Monahan, 2006). In the United Kingdom, crime elevation in schools led to the installation of CCTV to remotely monitor and enhance the safety of students, teachers and supporting staff (Hope, 2009). There have been emerging issues related to the privacy of students, especially in classrooms, but with the mushrooming of sleeper cells in schools, it is necessary to monitor the students, teachers and facilities in school to enhance their safety and response (Taylor, 2010). Electronic Security Surveillance Systems such as CCTV potentially promote the security and safety of the school community from the increasing crime and threat to schools (Yorke, 2010). By 2011, more than 85% of UK secondary schools had installed CCTVs.

These past events have contributed to the school administration's investment in electronic security surveillance systems to monitor and enhance the safety of the school community (Perry-Hazan & Birnhack, 2018). Students are most vulnerable to social crimes thus ensuring their safety is observed, and monitoring their environment in school gains prominence over ethics (James & Nettikadan, 2019). Furthermore, James & Nettikadan (2019) posit that the combination of CCTV and alarm systems enhances response time to any potential threats to students, teachers and facilities. Concerns for insecurities as well as academic performance have led to schools employing the use of surveillance systems (Ghimire & Rana, 2022).

Electronic security surveillance systems have been established to improve security, in secondary schools (Hope, 2015; Stoycheff, 2016). Electronic security surveillance currently controls security structures in cities, airports, terminals, traffic, supermarkets and malls among others which have improved transparency and mitigated security threats (Omolara *et al.*, 2022). Schools have been recipients of threats from burglary, arson and radicalisation into violent extremist and terror attacks.

CCTV systems are among the most commonly used electronic surveillance technologies in schools. They involve the installation of cameras that transmit video footage to a central monitoring station. The primary purpose of CCTV is to deter and detect criminal activities and to provide evidence in case of incidents (Norris & Armstrong, 1999). Studies have demonstrated that CCTV systems can be effective in reducing crime rates in various settings, including schools. However, the effectiveness of CCTV systems is contingent upon several factors, including the quality of the cameras, the extent of their coverage, and the responsiveness of the monitoring staff (Welsh & Farrington, 2009).

Matczak *et al.* (2023) conducted a study examining the effectiveness of CCTV systems as a crime prevention tool, using data from eight Polish cities. The study aimed to determine whether closed-circuit television (CCTV) systems effectively reduce crime and if the impact of CCTV is lasting. Employing a quasi-experimental approach, the researchers analyzed police data on four types of crime incidents from 2005 to 2014 and considered camera placement. They found that CCTV had a preventive effect in 10 out of 17 paired treatment and comparison areas, though the overall impact was modest. The effects were

durable in only two of the four crime categories analyzed. The findings indicate that while CCTV systems in these Polish cities contributed to a reduction in crime, the overall influence is limited and varies by crime type.

According to research, electronic security monitoring systems improve secondary school safety by lowering vandalism, theft and bullying. Johnson (2018) discovered a 30% decrease in vandalism and larceny in schools equipped with security cameras. Similarly, Parker *et al.* (2020) observed a significant drop in bullying incidences owing to the placement of surveillance cameras. Smith and Brown (2019) found that schools using advanced monitoring systems responded faster to emergencies, lowering potential injury. Furthermore, Williams (2021) determined that these systems work best when integrated with other security measures like regulated access points and frequent safety drills. Müller and Schmidt (2022) demonstrated in Europe how combining surveillance systems with artificial intelligence technology improves real-time threat detection and reaction. These findings highlight the need for constant monitoring and the deployment of new technologies to maximise the efficiency of electronic security surveillance systems in secondary schools.

The usefulness of electronic security surveillance systems in improving secondary school safety has been extensively researched. According to studies, while these technologies can inhibit criminal activity and increase overall security, their effectiveness varies greatly depending on the situation. In South Africa, for example, the installation of surveillance cameras in schools has been linked to fewer occurrences of vandalism and violence, resulting in a safer learning environment (Mncube & Harber, 2018). However, it should be

mentioned that the simple existence of monitoring systems is insufficient; their efficacy is substantially boosted when integrated with other security measures and a positive school atmosphere (Zulu, 2020). Furthermore, the integration and management of these technologies within the school context might impact students' and teachers' perceptions of safety (Nkosi, 2021). While electronic monitoring technologies show promise, their effectiveness in increasing school safety in African contexts requires comprehensive and context-specific measures (Mncube & Harber, 2018; Zulu, 2020; Nkosi, 2021).

The usefulness of electronic security monitoring systems, such as CCTV, in improving secondary school safety in Kenya has been extensively researched. According to studies, while these methods can inhibit criminal activity and improve students' and staff's perceptions of safety, their actual impact on decreasing violence and theft is mixed. For example, the study performed in Meru County discovered that CCTV surveillance in public boarding secondary schools reduced bullying and vandalism, but its usefulness was restricted by technological concerns and a lack of competent monitoring (Gitonga, 2020). Furthermore, larger research implies that the deployment of surveillance cameras alone may not significantly reduce school crime rates unless accompanied by other security measures and a supportive school atmosphere (National Association of School Psychologists. 2020). As a result, while electronic monitoring systems may be an important part of school safety initiatives, their performance is heavily dependent on full installation and integration with other safety procedures (Steiner *et al.*, 2021).

Atieno and Kinyanjui (2023) investigated the impact of technology on student discipline in public secondary schools in Nakuru County, Kenya. The study aimed to explore how

closed-circuit television (CCTV) affects student behaviour and discipline. Discipline is crucial for both academic success and the overall development of students. However, managing student discipline in Kenyan secondary schools remains a significant challenge, with many traditional techniques proving ineffective. The researchers employed an explanatory sequential mixed-methods design to compare schools that use CCTV and other technologies for discipline management with those that do not. The study involved ten schools, with five utilizing various technologies and five relying on conventional methods. The sample included 270 participants. The results revealed a positive correlation between the implementation of CCTV technologies and improved management of student discipline. Schools with CCTV systems demonstrated more effective discipline management compared to those without such technologies, suggesting that the use of CCTV can positively affect student behaviour and overall discipline.

Kirui *et al.* (2024) examined the impact of CCTV systems on police operations in Nairobi City County, Kenya, focusing on five key outcomes: crime reduction, response times, road safety, officer safety, and cost reduction. Although Nairobi's CCTV system has been operational since mid-2015, its effects were not well understood. The study utilized a convergent mixed-method design, incorporating both a cross-sectional survey and a phenomenological approach. The sample included 403 police officers from the CCTV command centre and various police stations, selected through cluster and purposive sampling. The findings indicated that CCTV significantly contributed to crime reduction, improved road safety, enhanced officer safety, and reduced operational costs. However, improvements in response times were limited, attributed to insufficient CCTV coverage

and coordination issues among officers. The study suggested expanding CCTV coverage, improving inter-officer collaboration, and publicizing the system's successes to fully realize its benefits.

2.5. Challenges in Optimal Operation of Electronic Security Surveillance Systems on Secondary School Safety

2.5.1 Challenges of Electronic Security Surveillance Systems

Threats faced by schools have prompted them to invest in modern technologies to track children and their activities and keep them safe (Matthew, 2017). Electronic security surveillance systems have both reactive (CCTVs and alarms) and proactive (metal detectors) approaches in schools (Jämsén & Marttila, 2015; Jaleel *et al.*, 2022). Operators need to be well conversant with the technology. Urban electronic security surveillance handles a dynamic haphazard crowd that is potentially exposed to many risks both outside and in schools (Bennett *et al.*, 2014). The failure of a human operator to detect threats while monitoring school activities negatively affects the safety of the school community (Harber, 2021). In addition to human operation challenges, failure to properly position CCTVs and alarms in schools minimises the security measures and enhances the risk to the students, teachers and facilities (Ghimire & Rana, 2022).

The detection performance on a multiple-scene display is not exclusively driven by the number of scenes in the display. It is hardly an ideal foundation for maintaining the safety of public spaces given that the efficiency of visual search is reduced with less detailed information (Biggs & Mitroff, 2014). Electronic security surveillance systems are

dependent on electricity which in most cases fail thus exposing the schools to potential threats (Perry-Hazan & Birnhack, 2019). In Nigeria, the application of CCTV for the surveillance of examinations has proven ineffective (Agwi *et al.*, 2021). Thus, posing the question of whether it could be effective to monitor threats to students, teachers and the facilities. Schools face challenges due to inadequate electronic security surveillance resources – CCTVs, burglar and fire alarms and metal detectors (Adams, 2016). It is an expensive affair that requires huge financial investment. The use of electric power to maintain the system is also expensive including expensive standby generators.

Gitonga (2020) identified several challenges in implementing CCTV surveillance technology for school safety, including frequent camera malfunctions, high maintenance costs, and a shortage of trained personnel to monitor the cameras effectively. To enhance school security, it was recommended that CCTV cameras be used more effectively. Additionally, Hankin *et al.* (2011) conducted a study on the impacts of metal detector use in schools, drawing on 15 years of research. The findings revealed that metal detectors harmed students' perceptions of safety. However, one study highlighted a significant positive outcome, showing that the use of metal detectors was associated with a decrease in the likelihood of students carrying weapons in school (7.8% vs. 13.8%), without affecting weapon carrying in other settings or reducing participation in physical fights.

Odediji and Olofin (2023) conducted a study on the impact of security challenges on the effectiveness of secondary school teachers in Osun State, Nigeria. The research specifically explored the relationship between various security challenges—such as terrorism, cultism,

and overall school safety—and teachers' effectiveness. The study utilized descriptive survey and correlational research designs, with a sample of 240 teachers from 24 public secondary schools, selected through a multi-stage sampling process. Data were collected using two self-designed instruments: the "Security Challenges Questionnaire (SCQ)" and the "Teachers' Effectiveness Questionnaire (TEQ)." The findings revealed no significant relationship between terrorism and teachers' effectiveness ($r = 0.011$). However, a significant negative relationship was found between cultism and teachers' effectiveness ($r = -0.412$, $p < 0.05$).

Another study was conducted by Birnhack *et al.* (2018) to investigate how primary school children perceive CCTV surveillance in their schools and how these perceptions influence their awareness of privacy. The research involved interviews with 57 children, aged 9 to 12, from three Israeli public schools equipped with CCTV systems, as well as insights from the schools' management teams. The study found that educators in all three schools did not discuss the presence or purpose of CCTVs with the children, leading to various misconceptions. Some children mistakenly believed that they were constantly being seen and heard, even in private spaces like toilets and classrooms. The findings highlighted a tension between the normalization of school surveillance and resistance to what the children perceived as excessive monitoring. Despite being young and accustomed to living in a digitally surveyed environment, the children valued their privacy and were only willing to sacrifice it when they felt it was justified. The children's reasoning about when it is appropriate to trade privacy for security mirrored constitutional principles, reflecting a sophisticated moral judgment on the issue.

2.6. Theoretical Framework

The study opted to use two theories that were important to explain the variables in this study on ESSS (installed, monitors the threats, operational; threat detection, effective in monitoring, threat reduction; infrastructures, skilled personnel, installation location). Objective one and objective three were guided by Contingency theory and objective two was guided by situational theory.

2.6.1. Situational Crime Prevention Theory

Situational Crime Prevention Theory was developed by the British Government's Criminological Research Department in the mid-1970s (Clarke, 1995). This theory then was developed to mitigate crimes. Situational crime prevention (SCP) theory seeks to mitigate the harms caused by crime by altering immediate or situational factors in the environment where crime regularly occurs.

Schools face threats from diverse sources – internal and external threats thus vigilance becomes a major part of mitigating the threats (Smith and Clarke, 2012). Schools and other institutions endeavour to prevent crimes and threats in their compound by installing electronic security surveillance systems to monitor activities in and around schools. Electronic surveillance systems installed in appropriate places help monitor threats to property such as vandalism, burglary, bullying and substance use. Rationality must be employed by the school administration to help protect the school community and the property. Altering the school environment by installing ESSS to prevent and mitigate crimes in the school compound. SCP seeks to change how potential offenders perceive opportunity in a particular environment or specific situation.

Electronic security surveillance systems make the potential offender that there is a high likelihood of getting caught after or before the fact. The perception of security is promoted by the presence of electronic security surveillance systems in schools. SCP attempts to change the perceptions of the information the potential offender processes regarding the gains, losses, and risks embodied in the situation. Electronic security surveillance systems are situational crime prevention. It is a perfect theory that applies to electronic security surveillance systems in schools thus looking at the strengths and weaknesses.

2.6.2. Contingency Theory

Contingency Theory also guided this study. Cole (1996) relates Contingency Theory to stress the need to “take specific circumstances or contingencies into account when devising appropriate organizational and management systems”. The theory sought to predict organizational behaviour by studying people, structures, technology and the environment. In other words, it is having the right things in place at the right time.

The relevance of this theory to the study is underlined in its definition and purpose. Contingencies must be put in place in organizational and management systems and the work to be done must be clearly outlined beforehand. It pointed to the need to establish whether infrastructure and environment designs are adequate for school safety. The flow of variables as illustrated above is in tandem with the conceptualization of Otley (1980) on contingency theoretical framework.

2.7. Conceptual Framework

The conceptual framework had independent variables, intervening variables and dependent variables. Electronic security surveillance systems were the independent variable. The independent variable looked at the nature and extent of electronic security surveillance systems in secondary school (installed, monitors threats and operational); effectiveness of electronic security surveillance systems in secondary school (threat detection, effective in monitoring threats and threat reduction); and the challenges in optimal operation of electronic security surveillance systems in secondary school (infrastructures, skilled personnel and installation location). The Independent variable had a unidirectional approach as it informed the dependent variable. The intervening variable was formed by the implementation of national ICT Policy in education and school policy on safety that informed both the independent variable and dependent variable. The dependent variable was secondary school safety (positive behaviour, threat prevention and positive academic performance).

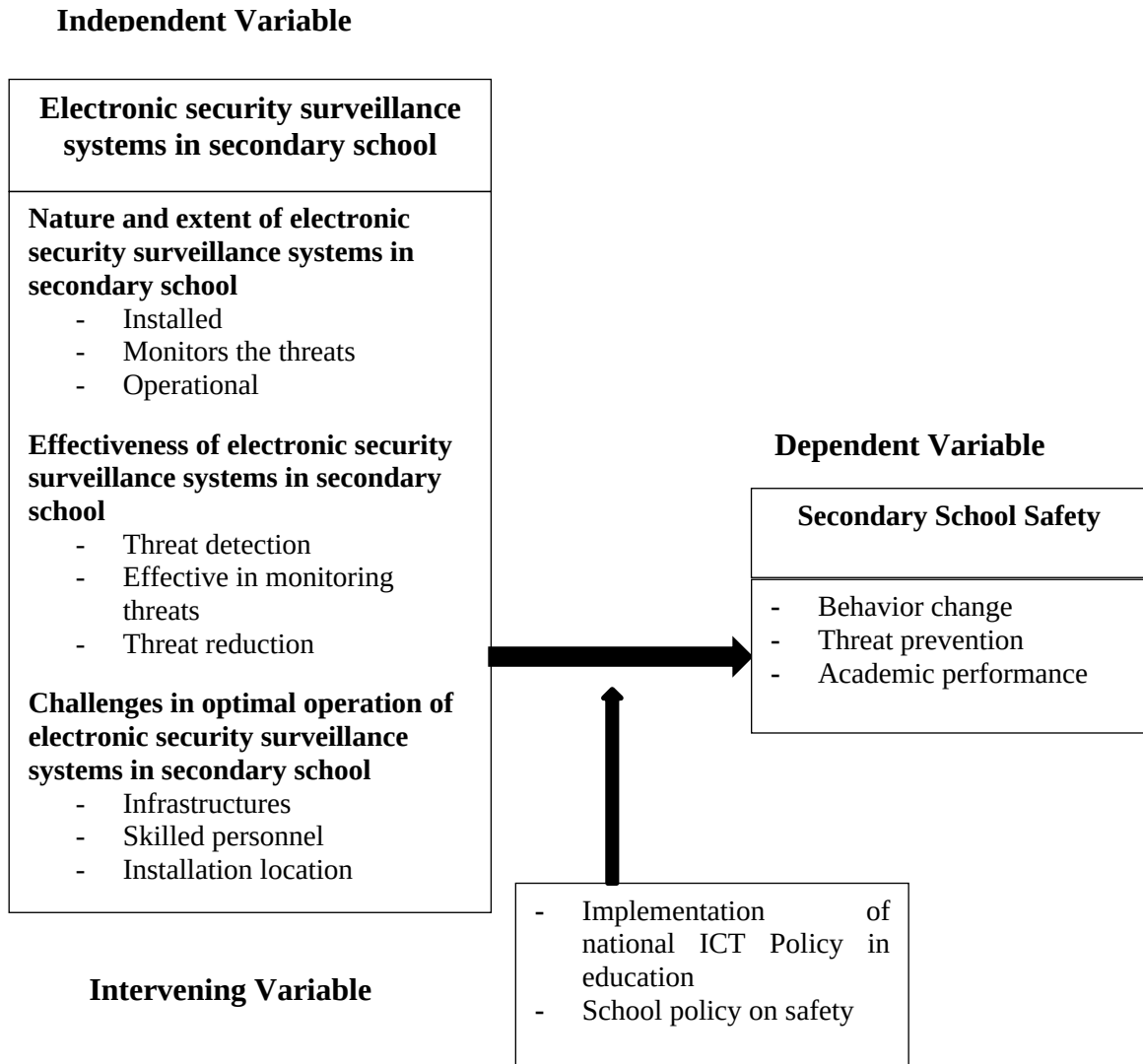


Figure 2.1: Conceptual Framework Model

Source: Researcher, 2022

The use of electronic security surveillance systems (ESSS), including CCTV cameras, biometric access systems, fire alarms, and metal detectors, plays a pivotal role in enhancing school safety. These systems allow for real-time monitoring of school environments, which leads to the early detection of potential security threats. For instance, CCTV cameras enable school authorities to track student movements and identify suspicious behaviour, while biometric access systems control unauthorized entry. Fire alarms ensure quick responses to

emergencies, reducing the likelihood of damage or harm. The presence of these technologies contributes significantly to preventing security incidents such as theft, arson, or violence within the school compound.

Furthermore, the effectiveness of ESSS is strongly influenced by school policies, such as national ICT policies and specific school safety protocols. These policies provide a framework for the consistent and systematic use of surveillance technologies. Schools that align their ESSS with well-structured policies benefit from clearer operational guidelines, which ensures that the systems are maintained and used optimally. For instance, integrating ESSS with national ICT policies can enhance data security and accountability, while school-specific safety protocols offer practical steps for managing potential crises. This compliance with regulatory frameworks leads to improved security outcomes and better crisis management in schools.

Another critical factor affecting the success of ESSS in schools is the training and management of personnel. Proper training ensures that school staff are knowledgeable in operating surveillance systems, interpreting the data generated, and responding promptly to alerts. When school personnel are well-equipped with the necessary skills, they can swiftly detect and address potential security threats, making the school environment safer. In contrast, poorly trained personnel may fail to use the ESSS effectively, leading to security lapses. Therefore, regular training and proper management of ESSS ensure that schools can fully leverage the potential of these systems to maintain safety.

Overall, the interaction between the presence of electronic security surveillance systems, supportive school policies, and well-trained personnel creates a robust security infrastructure. This, in turn, leads to safer school environments, reducing incidents of violence, theft, and other security threats, while promoting the well-being and confidence of students, teachers, and staff.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This section presents the methodology for the study. Sections covered include a study area, research design, target population, sampling technique, sample size determination, data collection procedure, data collection tools and piloting, reliability and validity tests, data analysis and ethical considerations.

3.2. Study Area

Trans Nzoia is one of Kenya's forty-seven counties, as outlined in the 2010 Kenyan Constitution (Figure 3.1). It comprises five sub-counties: Kiminini, Saboti, Endebess, Kwanza, and Cherangany, with a total of 25 wards. According to the 2019 Census, the county had a population of 990,341, consisting of 489,107 males, 501,206 females, and 28 intersex individuals. The county has 223,808 households, with an average household size of 4.4, as reported in the Census. Trans Nzoia lies approximately between latitudes 00° 52' and 10° 18' north of the equator, and longitudes 34° 38' and 35° 23' east of the Great Meridian. It borders the Republic of Uganda to the west, Bungoma and Kakamega counties to the south, West Pokot County to the east, and Elgeyo Marakwet and Uasin Gishu counties to the southeast (GoK, 2023).

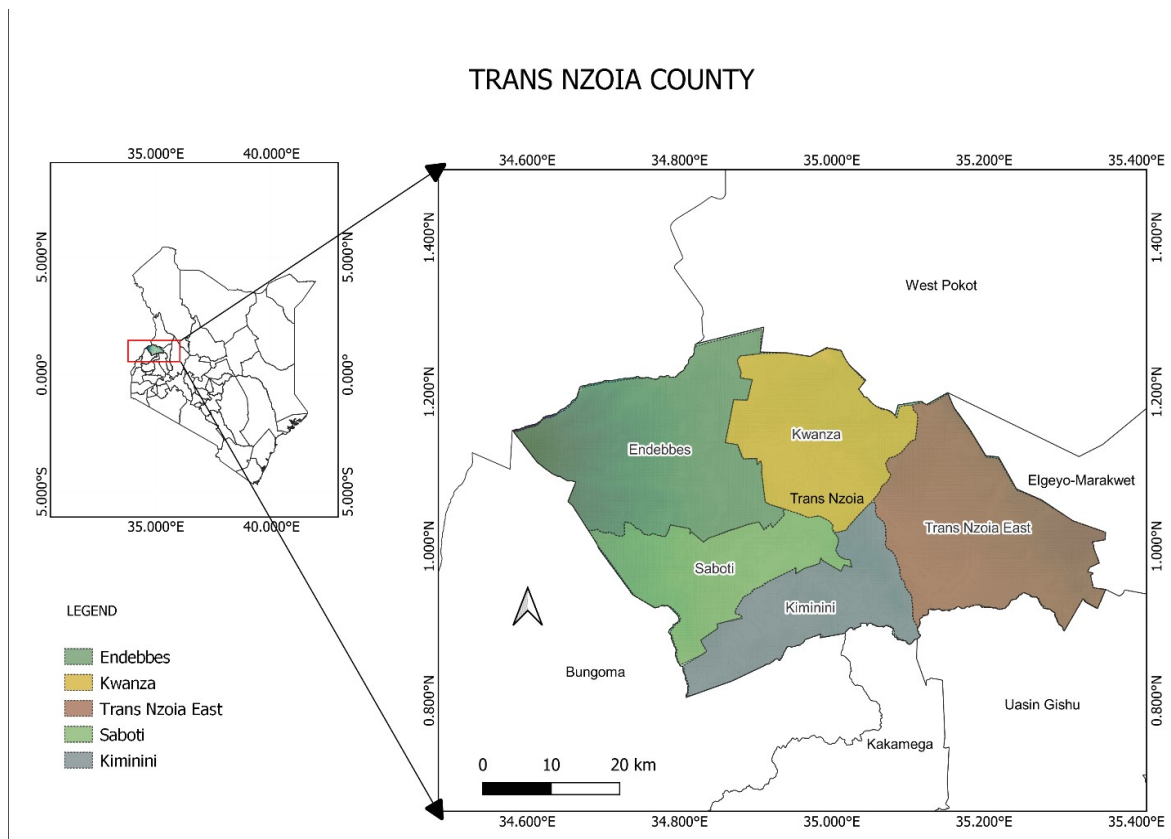


Figure 3.1: Map of Trans Nzoia County Showing Sub Counties

Source: Researcher (2022)

3.2.1. Physical and Topographic Features

The topography of Trans Nzoia County is generally flat, except for the Mt. Elgon and Cherangany Hills regions. On average, the county sits at an altitude of 1,800 meters above sea level. It is home to two major rivers, the Nzoia and Suam. Trans Nzoia is often referred to as the food basket of Kenya and boasts two natural forests, located in the Mt. Elgon and Cherangany Hills areas. The county experiences a highland equatorial climate, with annual rainfall averaging 1,200 mm (CIDP, 2023).

3.3 Research Design

This study utilized a descriptive survey research design, which blends both qualitative and quantitative approaches to provide accurate and relevant outcomes (Vanderstoep & Johnson, 2008). The research was conducted through surveys and observations of the presence of CCTVs, security alarms, and metal detectors at entry points and within school compounds. This design helped conceptualize the extent and application of electronic security surveillance systems (CCTVs, alarms, and metal detectors), which informed school safety policies, Ministry of Education support, and the sustainability of ESSS, enhancing the safety of students, teachers, and school facilities. The descriptive research design was chosen for its ability to provide a comprehensive understanding of the current state and application of ESSS in secondary schools. By employing both surveys and observations, the study was able to gather detailed and accurate data on the extent of these systems' implementation.

3.4. Study Population

The study population comprised both day and boarding secondary schools in Trans Nzoia County. Out of the 225 secondary schools in the county, this study focused on 14 schools with a history of security threats and that had installed electronic security surveillance systems. The schools were purposively selected. These schools were selected as the units of analysis. The units of observation included school principals, teachers (including senior teachers and boarding masters for boarding schools), security officers, the County Director of Education, the Department of Disaster Management in Trans Nzoia County, and the Chief Fire Officer.

Table 3.1: Secondary Schools in Trans Nzoia Sub Counties with Previous History of Security Threats

Trans Nzoia Sub-County	Number of schools with past security threats
Kwanza	2
Kiminini	2
Trans Nzoia East	5
Tran Nzoia West	3
Endebess	2
Total	14

Source: Researcher (2022)

3.5. Sample Strategy and Sample Size Determination

According to the County Directorate of Education record in Trans Nzoia County, there are 14 secondary schools with a previous history of security threats. Secondary schools in Trans Nzoia County with electronic security surveillance systems and a previous history of security threats (arson, terrorism, theft) formed the unit of analysis in this study.

The study employed both quantitative and qualitative approaches. Simple random sampling and purposive sampling formed the sampling strategy. The purposive sampling strategy was used in secondary schools that have ESSS and a previous history of security threats. Students, security personnel, the County Director of Education and the Chief Fire Officer were purposively selected. A simple random sampling strategy was used to select the principals and the teachers. The population categories for the study are summarized in Table 3.2.

Table 3.2: Sampling frame for Unit of Observation of Key Informants

Population category	Pop (N)	Sampling strategy	Samples size (n)
School Principals	14	Census method	14
Deputy Principal	14	Census method	14
Boarding teachers	14	Census method	14
Security officers	14	Census method	14
County Directors of Education	1	Purposive	1
Chief Fire Officer	1	Purposive	1
Students	10x7 FGDs	Quota	70

Source: Researcher (2022)

3.6. Data Collection Tools

A research instrument is a tool that aids in measuring the variable(s) of a study. According to Creswell (2013), descriptive survey methods can collect both quantitative and qualitative data using questionnaires and interview schedules, respectively.

3.6.1. Questionnaire

A structured questionnaire with both open and closed-ended questions was used to collect quantitative data on the nature and extent of electronic security surveillance systems in secondary schools in Trans Nzoia County; the effectiveness of electronic security surveillance systems on the safety in secondary schools in Trans Nzoia County and challenges in optimal operation of electronic security surveillance systems in secondary schools in Trans Nzoia County. Questionnaires were administered to the school principal (management), teachers and security personnel in secondary schools (Appendix II).

3.6.2 Interview Guides

The study employed key informant interview guides (Appendix IV, V). The interview guides targeted the County Director of Education and Chief Fire Officer in Trans Nzoia County. The interview questions were all open-ended, allowing the researcher to gain an in-depth understanding of the impact of electronic security surveillance systems on secondary school safety.

3.6.3 Focus Group Discussion

A focus group discussion guide was used to collect data from the students on the nature and extent of the use of electronic security surveillance systems, the effectiveness of electronic security surveillance systems and the challenges of electronic security surveillance systems faced by the schools. Seven focus group discussion forums were held to collect student opinions on the subject. The composition of the group consisted of ten students from various class levels in the schools.

3.6.4 Observation Checklist

An observation checklist was used to confirm the presence of electronic security surveillance systems in secondary schools in Trans Nzoia County. The observation checklist enabled the researcher to corroborate findings from the questionnaires and interview guides.

3.7. Data Collection Procedure

Data utilized in this study determined the impact of an electronic security surveillance system that enhanced sustainability and safety measures for students, teachers and the facilities in secondary schools in Trans Nzoia County. During data collection, the

researcher sought informed consent by reading a standard consent request form and asking for permission before proceeding with the data collection.

The researcher contracted a team of five research assistants who understood the terrain of Trans Nzoia County and were accessible to the schools under study. Thus, research assistants were trained for three days on data collection tools and approaches to questioning and observation of the presence of electronic security surveillance systems in schools. The research assistants worked under the instruction of the lead researcher. The use of local research assistants reduced the potential inability to access the selected secondary schools. The research assistants participated in data collection by administering the questionnaires and responding to an observation checklist. Key informant interviews were conducted by the lead researcher. The respondents were given enough time to respond to all the questions.

3.8 Pilot Testing of the Instruments

Pilot testing was conducted to test the research instruments with 10% of the sample size before the main study. The piloting took place in three secondary schools in Nandi County. This phase was crucial for assessing the reliability and validity of the research instruments. Additionally, the researcher identified and addressed weaknesses in the tools before proceeding with data collection, an approach supported by Blaikie & Priest (2019). This process ensured that the research instruments functioned smoothly and improved the overall quality of the study.

3.9 Reliability and Validity

3.9.1 Reliability

Reliability was tested for the degree of consistency of the research questions as per the research objectives. Therefore, a pilot of the research tools was carried out to check for consistency of respondents and understanding of the questions thus helping to adjust areas of concern before the full data collection exercise. The Cronbach's Alpha coefficient for comparing the internal reliability of items both in expectation and observation was $\alpha = 0.779$, which exceeded $\alpha = 0.7$ and thus passed the reliability test as supported by Taber (2018). The reliability of the data collection tools thus indicated that they were clear and instructions were easily understood.

Table 3.3: Reliability Statistics

Cronbach's Alpha	N of Items
0.779	23

3.9.2 Validity

Content validity measures how well the research instruments cover the variables important to the researcher and help achieve the study's objectives (Reeves & Marbach, 2016; Dunn, 2020). The researcher evaluated the data collection tools to ensure that the questions addressed the intended outcomes before collecting data from the selected population. Content validity was established through reviews of the tool and assessments of the relevance of the responses concerning the research questions by the supervisors.

3.10 Data Analysis and Presentation

The collected data was both quantitative and qualitative. Qualitative data was collected by open-ended questions that were classified based on common attributes/themes. The quantitative data were coded and entered into an appropriate computer package for analysis – IBM Statistical Package for Social Scientists version 25. The methods of analysis were both descriptive and inferential. The descriptive approach generated frequencies, percentages, measures of central tendencies and dispersion. Inferential approaches generated regression models (coefficient of determination and prediction). Data were analysed descriptively and inferentially at a 95% confidence level. This allowed for the estimation of the confidence intervals containing the true population parameters and the statistical significance of the factors on electronic security surveillance systems as a sustainability and safety measure in secondary schools. The resulting frequencies and percentages were presented using tables and figures. Key informant guide data sheets were transcribed and reported verbatim. Table 3.4 summarises the statistical techniques.

Table 3.4: Summary of Statistical Techniques

Specific Objectives	Measurable variables	Data collection technique	Methods of data analysis
Objective 1: Nature and extent of electronic security surveillance systems	• Type of ESSS Installed • Coverage area • System features and capabilities • Duration of use of ESSS	Questionnaire, Interview & observation checklist	• Descriptive • Inferential
Objective 2: Effectiveness of electronic security surveillance systems on safety	• Threat detection • Efficient in monitoring • Threat/ security incidents • Response time • System reliability • System downtimes	Questionnaire, Interview & observation checklist	• Descriptive • Inferential
Objective 3: Challenges in the optimal operation of electronic security surveillance systems	• Training and competency • Installation location • Adoption of new technologies	Questionnaire, Interview & observation checklist	• Descriptive • Inferential

Source: Researcher (2022)

3.11 Limitations of the Study

The study had the following limitations;

- i. Some schools may not have had up-to-date records or comprehensive data on their electronic security surveillance systems, which could lead to gaps in understanding the full extent and nature of these systems. This was overcome by using other data

sources like key informants and focus group discussions to help in triangulating the data.

- ii. Schools may have varying levels of willingness to share information about their security systems and incidents, leading to incomplete or biased data. This was overcome by explaining to the school administration that the information was confidential and was to be used in this study only.
- iii. Stakeholder perceptions of challenges may be biased by personal experiences or interests, which could affect the objectivity of the findings. This limitation was overcome by having more diverse stakeholders in the study to provide more insights into the challenges.

3.12 Assumptions of the study

The following assumptions guided the study;

- i. It was assumed that all secondary schools in Trans Nzoia County with electronic security surveillance systems provided accurate and complete information about the nature and extent of these systems.
- ii. It was assumed that the electronic security surveillance systems in place were operational and functioning as intended at the time of the study.
- iii. It was assumed that stakeholders, including school administrators, security personnel, and teachers, were willing to share their experiences and insights regarding both challenges related to electronic security surveillance systems.

3.13 Ethical Considerations

The researcher obtained permission from the Directorate of Postgraduate Studies (DPS) at Masinde Muliro University of Science and Technology. Additionally, a research permit was secured from the National Council of Science, Technology and Innovation (NACOSTI) (Appendix VIII) after receiving the permission letter from the DPS. The researcher also sought approval from the County Commissioner (Appendix IX) and the Director of Education for Trans Nzoia County (Appendix X) before conducting the study. The confidentiality of individual participants was strictly observed, ensuring that all personal information remained anonymous. The researcher protected participants' identities by concealing their names and other personal details. Furthermore, respondents were informed about the nature of the study before data collection commenced.

CHAPTER FOUR

NATURE AND EXTENT OF ELECTRONIC SECURITY SURVEILLANCE SYSTEMS ON SECONDARY SCHOOL SAFETY

4.1 Introduction

This section presents response rates from the tools distributed for data collection, demographic information for the respondents, and descriptive and inferential statistics analyses were presented.

4.2 Response Rate of Study Populations

A total of 56 questionnaires were administered to principals (14), deputy principals (14), boarding teachers (14), and security officers (14), achieving a 100% response rate. Interview guides were used to collect data from the County Director of Education (1) and the Chief Fire Officer (1), both of whom had a 100% response rate. Additionally, students were interviewed through focus group discussions, with seven groups comprising 10 members each, for 70 students, all contributing to a 100% response rate. Table 4.1 provides the response rate for each respondent category.

Table 4.1: Response Rate of Study Populations

Category	Type of tool	Issued	Returned	Percentage
Principals/	Questionnaire	14	14	100%
Deputy principals	Questionnaire	14	14	100%
Boarding teachers	Questionnaire	14	14	100%
Security officers	Questionnaire	14	14	100%
Chief Fire Officer	Interview	1	1	100%
County Director of Education	Interview	1	1	100%
Students	FGD	(10 x 7)	70	100%
Total		128	128	100%

Source: Field data (2023)

According to Zikmund *et al.* (2014), a response rate of at least 50% is generally considered sufficient for data analysis. Therefore, the response rate of 100% was deemed excellent, and the analysis was based on this rate.

4.3 Demographic Characteristics of Respondents

These sections provide information on the respondents' demographic characteristics i.e., gender and work experience. Findings are presented in sections 4.3.1 and 4.3.2.

4.3.1 Age of the Respondents

The study sought to establish the gender of the respondents. Table 4.2 describes the age of the respondents as shown.

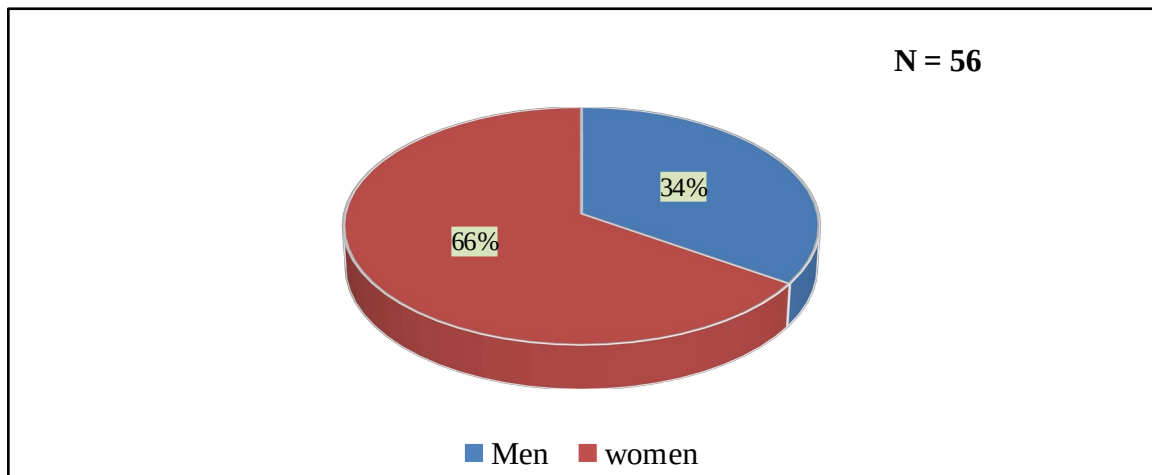


Figure 4.1: Gender of the respondents

Source: Field data (2023)

From Figure 4.1, the majority of the respondents 38 (66%) were female while 20 (34%) were male respondents. This gender mix was a confidence of the data which was representative and hence minimized gender stereotypes. Alsulami (2016) and Heinemann

(2014) observe that gender balance in studies promotes varied perspectives, resulting in more thorough and inclusive conclusions. Furthermore, Ahmad (2016) contends that gender representation in research contexts reduces the potential of propagating stereotypes while also addressing gender-specific issues, particularly in studies involving educational or occupational environments.

This study's equal gender distribution lends legitimacy to its findings, ensuring that they are not distorted by a disproportionate representation of one gender over another. This is consistent with the concepts described by Huang and Hong (2016), who emphasise the need for equitable gender involvement in improving the research's validity. Thus, the gender mix in this study improves its general dependability and decreases the possibility of gender bias in the outcomes.

4.3.2 Work Experience

The study established the work experience of the respondents. Figure 4.2 summarizes the findings.

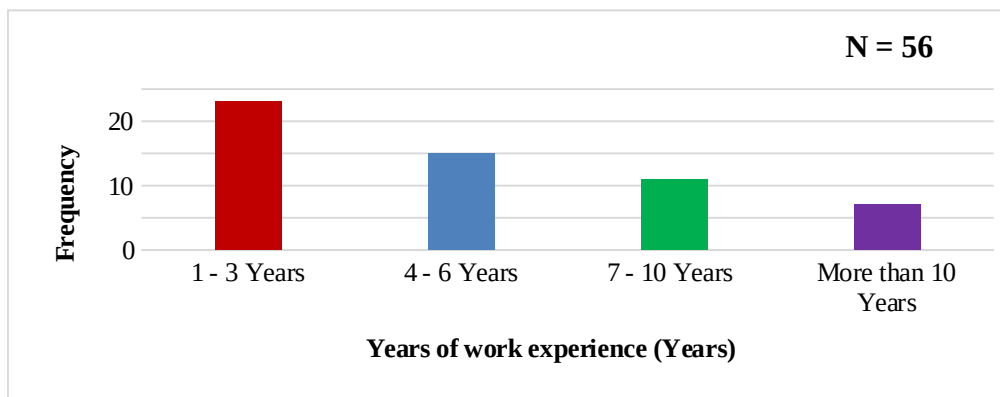


Figure 4.2: Work experience of the respondents

Source: Field data (2023)

Figure 4.2 reveals that the majority of the respondents 23 (41%) had a work experience of between 1-3 years, 15 (26.8%) had worked for between 4-6 years, 11(19.6%) had served for between 7-10 years and 7 (12.5%) had served for over 10 years. This was evident that the data collected came from a good mix of respondents who had relatively lengthy work experience hence; the data could be more trusted. This finding was in agreement with all the discussants and all the key informants.

This finding is consistent with previous research, which emphasises the significance of including respondents with diverse degrees of experience in order to maintain data richness. For example, Ahmad (2016) and Lawrence (2018) argue that a diverse group of respondents with varying degrees of experience can result in more balanced opinions and a better understanding of workplace dynamics. Furthermore, Bilyalova (2017) contends that involving both fresher and more seasoned professionals in research provides vital insights into how practices evolve over time, making the findings more complete.

The harmony between the findings and the perspectives of all discussants and key informants adds to the legitimacy of the conclusions. Tchamyu, Asongu and Odhiambo (2019) argued that validating quantitative data with qualitative comments from experts or key informants improves research firmness. Furthermore, Okombo and Muna (2017) believe that including diverse job experience enables cross-validation, ensuring that different perspectives are captured.

4.4 Current Status of Secondary School Safety

The study sought to determine the secondary school safety status. Figure 4.3 summarises the findings. Findings in Figure 4.3 show that 30 (70.5%) and 8 (17.9%) of the respondents

agreed and strongly agreed that electronic security surveillance systems provided safety in secondary schools. Further, 3 (6.4%) were undecided, 2 (3.8%) disagreed and 1(1.3%) strongly disagreed.

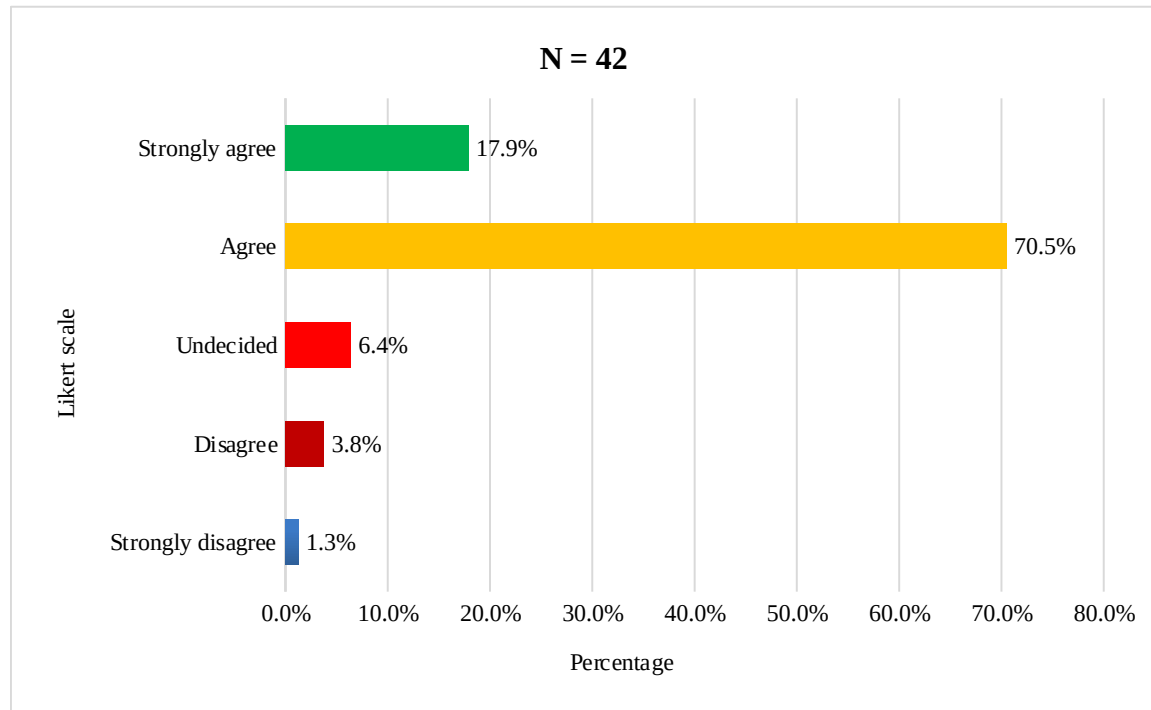


Figure 4.3: Agreement on the current status of Electronic Security Surveillance Systems in Ensuring Secondary School Safety

Source: Field data (2023)

These findings in Figure 4.3 about the teaching staff and school management agreement regarding the current status of ESSS in secondary schools, were consistent with other similar studies that emphasised the necessity of electronic surveillance in improving school security. Alsulami (2016) addressed the crucial role those technological interventions, such as security cameras, have in protecting safety in educational institutions by discouraging possible attacks and increasing response times to security incidents. Similarly, Bilyalova

(2017) emphasised the use of technology in current educational settings to create a safer environment for students and staff, hence improving overall learning outcomes.

However, the few respondents in Figure 4.3 who were undecided or disagreed indicated that, while electronic monitoring systems were broadly approved, there might still be reservations about their effectiveness. This is consistent with Huang and Hong's (2016) findings, which state that the success of surveillance systems depends on aspects such as appropriate maintenance, staff training and system coverage. Furthermore, Ahmad (2016) emphasised that while electronic systems were useful, they should be supplemented with additional safety measures such as personnel presence and explicit safety rules. Table 4.2 summarises the role of ESSS in schools.

Table 4.2: Role of Electronic Security Surveillance Systems in Ensuring Secondary School Safety

Secondary School Safety by ESSS	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
The electronic security surveillance system has led to positive behaviour among the school community	0.0%	2.6%	3.8%	80.8%	12.8%
The electronic security surveillance system has mitigated security threats and improved safety in the school	0.0%	1.3%	1.3%	71.8%	25.6%
Increased safety in the school has led to improved and positive academic performance by the students and teachers	2.6%	6.4%	19.2%	57.7%	14.1%

Source: Field data (2023)

Findings in Table 4.2 show that 45 (80.8%) and 7 (12.8%) respondents agreed and strongly agreed that the electronic security surveillance system has led to positive behaviour among the school community. The indecision concerning the electronic security surveillance system has led to positive behaviour among the school community was obtained from 3 respondents (3.8% of the total respondents).

The findings in Table 4.2 were consistent with previous research on the positive impact of electronic surveillance on school behaviour management since it frequently discouraged bad behaviours, such as bullying and vandalism while promoting accountability and discipline. Alsulami (2016), Huang and Hong (2016), and Bilyalova (2017) found that surveillance systems helped to create a more compliant and secure school environment. However, with only 3.8% of respondents uncertain, it showed that some people had not been exposed to these benefits or needed more information on surveillance's role in behaviour improvement. Ahmad (2016) and Li *et al.* (2018) proposed that the success of monitoring was dependent on proper implementation and the setting of explicit behavioural expectations.

Further, the findings (Table 4.2) show that 40 (71.8%) and 14 (25.6%) respondents agreed and strongly agreed that electronic security surveillance systems have mitigated security threats and improved safety in the school according to 71.8% and 25.6% (of the total respondents) respectively. One (1.3%) respondent was undecided as to whether the electronic security surveillance system has mitigated security threats and improved safety in the school. Contrary, one (1.3%) respondent disagreed that electronic security surveillance systems have mitigated security threats and improved safety in the school.

The findings in Table 4.2 were consistent with the broader research, supporting the idea that electronic security measures were critical in improving safety in educational settings. For example, the World Health Organisation (WHO) (2018) emphasised the importance of school safety for effective learning, with monitoring systems acting as a deterrent to possible risks, resulting in a more secure educational environment. Timammy and Oduor (2016) found that schools with strong security measures, including electronic surveillance, had fewer occurrences of violence and criminality, which matched respondents' opinions about the usefulness of surveillance in lowering security threats. Furthermore, Okombo and Muna (2017) emphasised the psychological benefits of surveillance, which fostered a sense of safety in students and staff, resulting in a more focused learning environment. Only one respondent disagreed with the effectiveness of surveillance, indicating a high degree of contentment and perceived security, which is consistent with Kandagor's (2020) conclusion that effective security measures enhanced confidence in school safety.

Finally, findings (Table 4.2) show that 32 and 8 respondents agreed and strongly agreed that increased safety in the school has led to improved and positive academic performance by the students and teachers according to 57.7% and 14.1% respectively. Findings established that 15 respondents were undecided as to whether increased safety in the school has led to improved and positive academic performance by the students and teachers. Contrarily, 4 and 1 respondents disagreed and strongly disagreed that increased safety in the school has led to improved and positive academic performance by the students and teachers according to 6.4% and 2.6% respectively.

The findings in Table 4.2 were consistent with previous research that emphasised the importance of a secure learning environment as the cornerstone for academic achievement. Chege (2014) observed that safe educational settings enabled students and teachers to focus on their work without being distracted by safety concerns, resulting in improved academic achievements. Respondents' positive assessments of safety's impact on performance aligned with broader educational ideas, which advocate for secure surroundings as a precondition for effective learning (Mwakio, 2021). Furthermore, the data supported Ndwiki and Thinguri's (2017) conclusion that increased safety measures contributed to a better school climate, hence improving student involvement and performance. This recognition of safety's impact on academic achievement was consistent with the findings of Ntorukiri *et al.* (2021), who discovered that safe surroundings supported improved academic outcomes and increased student retention and satisfaction.

Table 4.2 showed 15 undecided responses which indicated a range of experiences or perceptions about the direct influence of safety on academic performance, emphasising the importance of schools communicating how safety measures help the educational experience. Providing statistics on academic improvements linked to safety could help to reduce uncertainties and develop stronger consensus. While a tiny minority disagreed that increasing safety benefited academic performance, more discussion and information could lead to a more widespread understanding of safety's benefits in schools (Arthur-Nyarko & Kariuki, 2019).

4.5 Electronic Security Surveillance Systems Installed in Secondary Schools

The study sought to establish the combination of various electronic security surveillance systems installed in schools as shown in Figure 4.4 from the teachers (principal, deputy principal and teachers in charge of the boarding facilities). Findings in Figure 4.4 showed that 40 respondents said that secondary schools had only installed CCTVs according to 71.8% of the total respondents. From the findings, 13 respondents said that secondary schools had both CCTVs and alarms according to 23.1% of the total respondents. Finally, 3 respondents said that secondary schools had CCTVs, metal detectors, alarms and biometrics according to 5.1% of the total population.

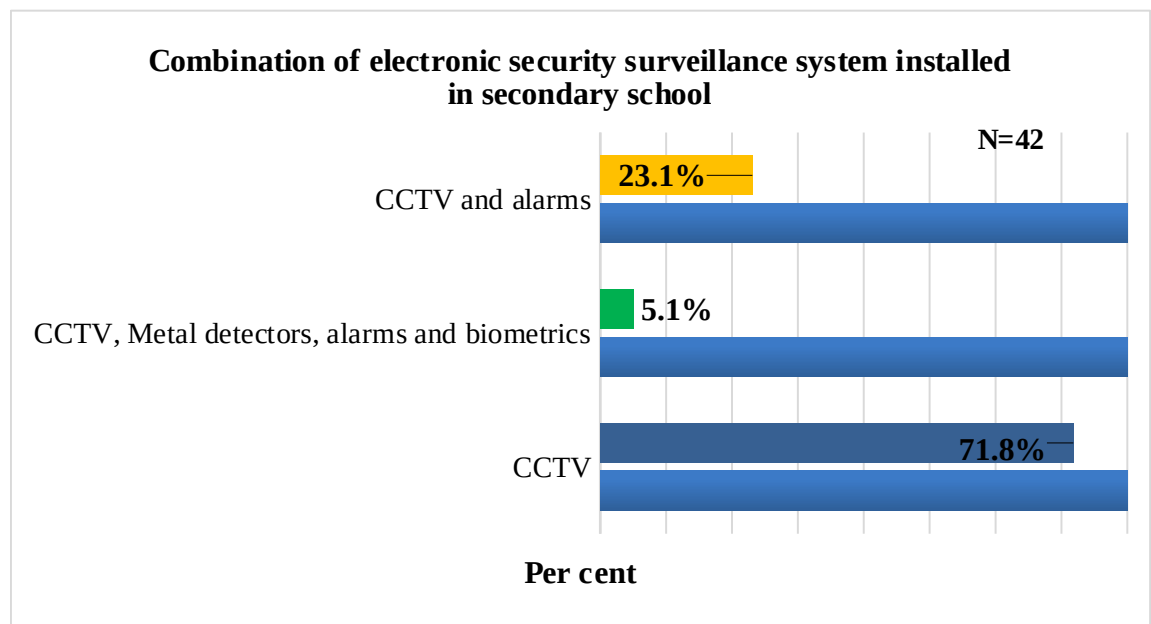


Figure 4.5: Combination of electronic security surveillance systems installed in secondary schools

Source: Field data (2023)

Findings in Figure 4.4 on electronic security surveillance systems deployed in secondary schools show a significant reliance on Closed-Circuit Television (CCTV) systems, with

71.8% of respondents reporting that their schools have only used this sort of surveillance. This trend emphasised the importance of monitoring and documenting to improve school safety, as CCTV systems provided continuous surveillance of school environments, deterring possible threats and enabling rapid incident responses (Heinemann, 2014).

Findings in Figure 4.4 also showed that 23.1% of respondents reported installing both CCTVs and alarm systems, indicating a trend towards a more integrated security approach. The combination of CCTV and alarm systems produces a reinforced security framework that not only observes activity but also allows for fast notifications in the event of security violations. This is consistent with prior studies showing the effectiveness of multilayer security measures in educational institutions (Timammy & Oduor, 2016).

Furthermore, a tiny minority of respondents (5.1%) reported the presence of modern security systems such as CCTV cameras, metal detectors, alarms, and biometrics. This suggests that, while the majority of schools rely heavily on CCTV, there is a growing tendency towards more advanced security solutions that improve safety standards. The incorporation of biometric technology, in particular, can greatly improve access control by guaranteeing that only authorised workers can enter the school grounds (Ngavana 2018).

However, the dependence on CCTV alone raises concerns about the breadth of security measures at some institutions. CCTV cameras are useful for monitoring, but they do not actively prevent security issues. Relying only on surveillance without implementing proactive security measures, such as on-site personnel or alarm systems, may expose schools to incidences of violence or unauthorised entrance. This restriction has been identified in the literature, emphasising the importance of educational institutions taking a

comprehensive approach to security (Ashiono, 2016). Figure 4.5 illustrates the CCTV coverage in schools.

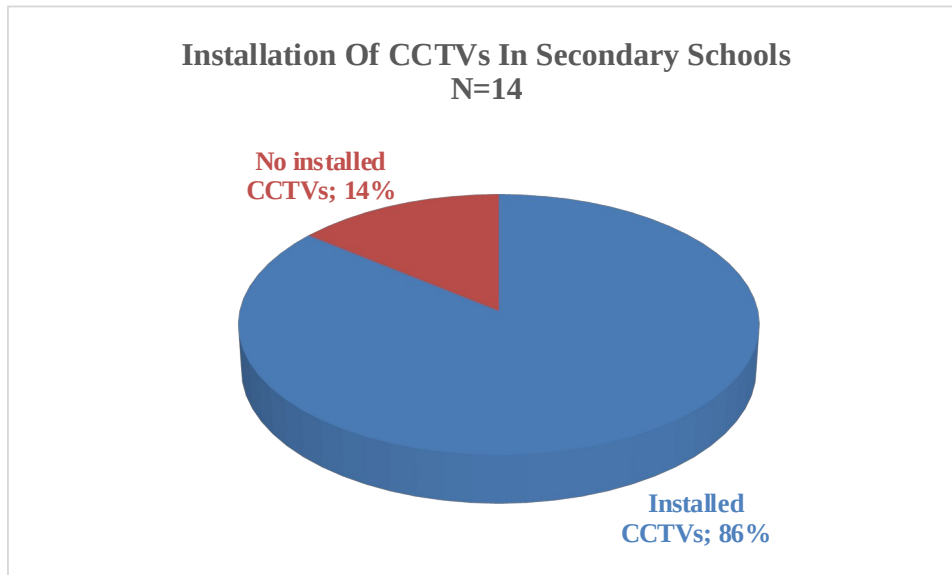


Figure 4.5: Installation Of CCTVs In Secondary Schools

Source: Field Data (2023)

According to the observation checklist, 12 of the 14 examined secondary schools have installed Closed-Circuit Television (CCTV) systems, demonstrating a strong commitment to improving security in educational contexts. The planned positioning of these cameras - two at the gate and ten 15 to 20 metres away from the main gate demonstrated a deliberate strategy to monitor access points and crucial places within the school perimeter. This positioning technique deters possible invaders and provides a complete view of activity within and outside the school grounds, boosting overall safety (Ratheeswari, 2018).

Furthermore, the discovery that CCTV servers were mostly deployed in the principal's office raises several critical questions. The principal's office frequently functions as a

primary administrative hub and putting the servers there makes for easy access and oversight. However, this move raises an important issue: the lack of a designated technician in charge of monitoring and controlling the CCTV systems. Without a committed individual to monitor CCTV operations, there may be delays in responding to problems or analysing footage as necessary, reducing the effectiveness of surveillance systems.

According to the scholarly review, efficient administration of security systems is critical for maximising their benefits (Heinemann 2014). The lack of a technician not only creates operational hazards but also emphasises the importance of training and capacity building within school administrations to improve security standards. According to research, appropriately trained workers may considerably improve the effectiveness of security systems by regularly monitoring and maintaining them (Mwakio, 2021).

Furthermore, this situation emphasises the significance of having a complete security strategy that includes employee training on how to operate and manage security systems properly. Schools may establish a safer and more secure environment for students and staff by investing in human resources as well as technical improvements (Kandor & Ngavana, 2018).

Many FGD participants stated that 'CCTVs are in place as a main electronic security mechanism in our school.' They frequently cited CCTV systems, emphasising the universal use of this CCTV technology. This was said by a member that:

...Our school relies on CCTVs as part of our security procedure, because it provides a wide coverage of the school compound that helps protect the school n from external intruders and possible internal threats (FGD, 2023).

The FGD members gave reasons supporting the installation of CCTVs that theft was a primary reason in schools. An FGD member said that:

... There have been increasing cases of theft in our schools, especially among students which prompted the school administration to install CCTVs (FGD, 2023).

Another reason for the installation of CCTVs in secondary school was born from frequent sneaking of students from school. A member of the FGD said that:

... Students having to sneak at night from school and return just before attending morning preps. Some have been sneaking back into school upon being sent home for school fees. It was quite stressful for the principal. I think that might have occasioned the installation of CCTVs in order to monitor sneaking (FGD, 2023).

The focus group discussions (FGDs) offered useful information about the attitudes and arguments for installing CCTV systems in secondary schools. Participants indicated strong agreement, adding that CCTVs were in place as a main electronic security mechanism in our school, emphasising the critical significance of CCTV technology inside educational institutions' security frameworks. This was consistent with earlier research that showed the frequency and usefulness of monitoring systems in ensuring school safety and security, as mentioned by Alsulami (2016) and Nduati (2016).

Participants emphasised how CCTV systems offered extensive coverage throughout the school property, which was critical for defending against both exterior invaders and internal dangers. The recognition of CCTVs as deterrents to prospective criminal activity indicated a proactive approach to security management. The capacity of CCTVs to monitor

broad areas played a critical role in protecting the school from theft and other security breaches, supporting their importance in the institution's overall safety policy.

Concerns about the increased incidence of theft among students added to the argument for installing CCTV cameras. FGD members testified that the threat of theft has become a major concern for school administrators, forcing them to invest in monitoring equipment. This echoed results from current research, demonstrating that improved security measures, such as CCTV installations, frequently evolved as reactions to rising criminal activity inside school contexts (Timammy & Oduor 2016; Okombo & Muna, 2017). Furthermore, the frequent absence of students from school, particularly at night, was cited as another key factor for CCTV installation. Participants discussed the difficulties that school administration had in monitoring student behaviour and guaranteeing safety, emphasising the need for dependable monitoring methods in fostering a secure learning environment.

4.5 Duration of Electronic Security Surveillance Systems Installation in Secondary Schools

The study determined the period in which secondary schools had installed electronic security surveillance systems. Findings in Figure 4.6 show that 40 respondents (51.3% of the total respondents) said that electronic security surveillance systems had been in existence between five years and nine years. Schools with electronic security surveillance systems installed and operated between one year and four years were said by 38 of the respondents (48.7% of the total respondents).

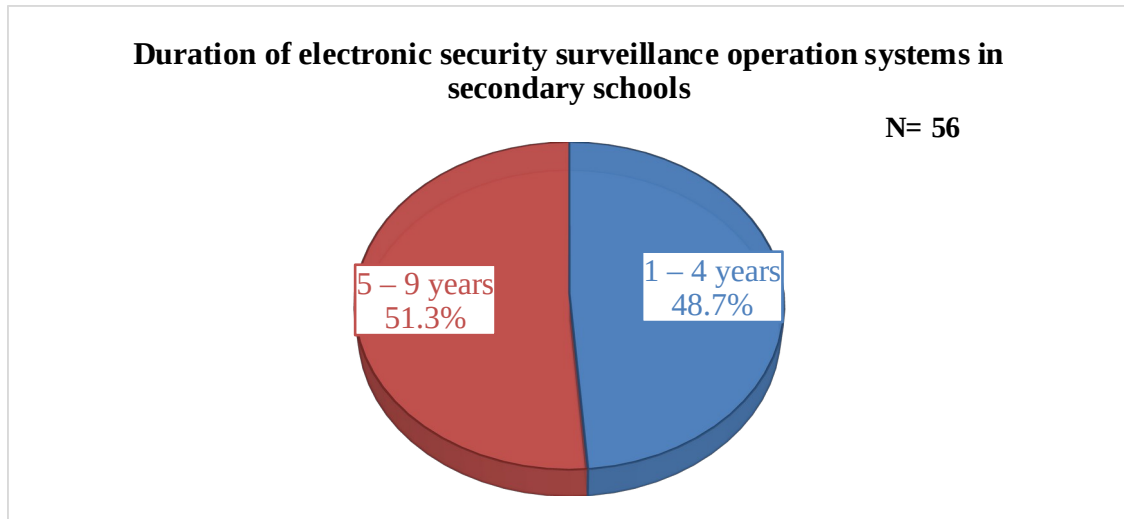


Figure 4.6: Duration of electronic security surveillance systems operation in secondary schools

Source: Field data (2023)

The frequency of systems deployed for five to nine years demonstrated a rising appreciation for the value of long-term investment in security infrastructure. Schools that had their surveillance systems in place for this long period of time undoubtedly saw the benefits of such technology in terms of increasing safety and lowering risks related to theft, vandalism, and other security concerns. This inference was consistent with prior research, which showed that schools were increasingly relying on electronic surveillance to ensure secure learning environments (Bulamba *et al.*, 2022; Osei *et al.*, 2018). The endurance of these systems was also viewed as evidence of their efficacy in creating a safer environment for students and staff.

On the other hand, the fact that 48.7% claimed that their schools had implemented security systems over the previous four years suggested a recent trend towards increased security measures. This urgency of newer technologies represented a rising awareness of safety

problems in educational settings, as well as school administrators' proactive efforts to address possible weaknesses. In light of increased school-related crime and safety concerns, the use of electronic security surveillance has become more important for protecting children and school property (Timammy & Oduor, 2016; Ngugi & Wambugu, 2022).

Furthermore, the findings on installation length indicated that schools were at varying degrees of security augmentation. Some had benefited from long-term technological expenditures, allowing for improved integration of security systems into their operations, whilst others were still in the process of building surveillance capabilities. This gap in experience may have had an impact on the overall efficacy of security measures in place since institutions with longer operating histories are more likely to have polished their monitoring and management tactics over time.

4.6 Nature and Extent of Electronic Security Surveillance Systems on Secondary School Safety

The researcher sought to determine the nature and extent of electronic security surveillance systems in the promotion of secondary school safety. The study determined the nature and extent of the use of electronic security surveillance systems using a five-point Likert scale data type – agreement levels.

Findings in Figure 4.7 show that 27 and 22 respondents said that they agreed and strongly agreed with the statement that the nature and extent of electronic security surveillance systems promoted safety in secondary schools according to 42.3% and 34.6% of the total respondents. Of the total respondents in Figure 4.7, 4 respondents (6.4%) were undecided

about whether the nature and extent of electronic security surveillance systems promoted secondary school safety. It was revealed conversely by 7 and 3 respondents saying that they disagreed and strongly disagreed that the nature and extent of electronic security surveillance systems promoted secondary school safety according to 11.5% and 5.1% of the total respondents respectively. The study found that 76.9% of total respondents were in agreement that the availability of electronic security surveillance systems and their quality of monitoring the events happening in the school helped promote secondary school safety. Figure 4.7 summarises the findings.

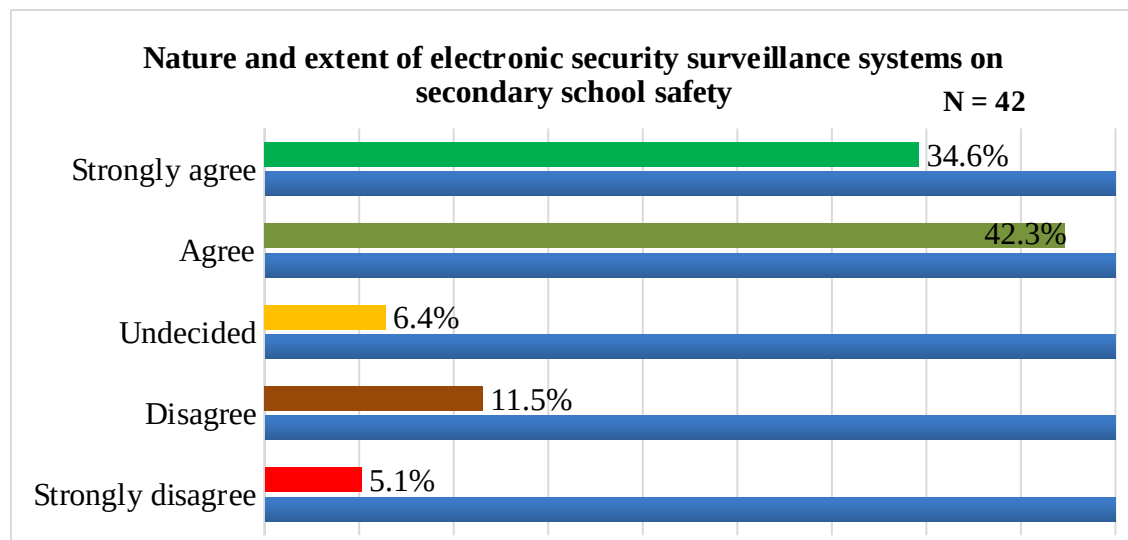


Figure 4.7: Nature and extent of electronic security surveillance systems on secondary school safety

Source: Field data (2023)

Figure 4.7 shows that respondents strongly agree that electronic security surveillance systems have a good influence on secondary school safety. A total of 60 respondents (76.9%) agreed or strongly agreed that the type and scope of these systems successfully

promoted safety in school settings. This overwhelming majority emphasises the perceived importance of monitoring technology as a key component of school safety procedures.

It was believed that ESSS allowed continuous surveillance of school premises, which was crucial for spotting and responding to possible security threats in real time the capacity to record and examine video footage can reduce criminal behaviour and increase accountability among students and staff (Osei *et al.*, 2018). This is consistent with previous studies indicating that schools outfitted with monitoring systems had fewer occurrences of theft and violence, providing a safer learning environment (Timammy and Oduor, 2016).

Furthermore, respondents' agreement on the quality of monitoring provided by these technologies demonstrates an understanding of the need to have a strong and dependable surveillance infrastructure. Quality monitoring not only assures complete coverage of school facilities but also enables rapid reactions to security problems. The results show that 33 respondents (42.3%) agreed with the statement, while 27 (34.6%) strongly agreed, indicating a significant conviction in the efficiency of these systems in improving safety measures.

However, it is worth noting that a tiny minority of respondents were uncertain or disagreed with the assertion about promoting safety through electronic surveillance devices. Specifically, 5 respondents (6.4%) were unsure, while 9 (11.5%) disapproved and 4 (5.1%) strongly opposed. This opposition may reflect worries about the sufficiency of security measures or judgements of the systems' usefulness in certain settings. These impressions may be influenced by factors such as the adequate training of workers on how to utilise surveillance technology or the quality of the devices implemented (Bulamba *et al.*, 2022).

The presence of differing viewpoints may also indicate wider concerns about privacy and the ethical implications of surveillance in educational settings. As schools use such technology, administrators must address these issues openly, ensuring that the primary focus remains on student and staff safety while preserving individual privacy rights (Ngugi & Wambugu, 2022). The balance between security and privacy is an important discussion that must continue as schools adjust to changing safety requirements.

According to the key informant interview, it was revealed by one of the respondents that show states that:

... Since the installation of electronic security surveillance systems, there has been a reduction in threat cases reported in secondary schools. Initially, there were many cases this office used to handle regarding insecurity in schools majorly theft and indiscipline in schools (Chief Fire Officer, 2023).

Furthermore, it was established from the FGD forum where discussants believed that since the installation of CCTVs in schools there has been a tremendous reduction in theft especially among students many who were caught stealing were shamed in public.

These interviews demonstrated that electronic security surveillance systems had a considerable favourable influence on secondary school safety and security. The responder saw a decrease in reported threat instances, notably theft and indiscipline, which is consistent with literature supporting surveillance technologies as effective criminal deterrents (Ratheeswari, 2018). The use of surveillance cameras serves as a disincentive to prospective perpetrators, resulting in a safer environment for students and staff. Furthermore, these technologies provide real-time monitoring, allowing authorities to respond quickly to problems and encouraging a proactive security strategy (Kandugor,

2020). The decline in indiscipline instances suggests that surveillance may inspire students to behave better (Ngavana, 2018). While the reduction in threat instances is encouraging, issues about privacy and ethics arise, emphasising the importance of open communication among school administration, staff, students, and parents to ensure individual rights are protected (WHO, 2021).

The comment of a Focus Group Discussion (FGD) member emphasised the critical psychological deterrent effect of Closed-Circuit Television (CCTV) systems in schools, notably in lowering theft incidences. The participant stated that "students fear getting caught and shamed, highlighting how social responsibility impacts behaviour. According to research, when people are aware they are being observed, their chance of participating in wrongdoing reduces dramatically (Kafuku, 2020). This dread of being caught on video, combined with the possible social stigma of humiliation, serves as a strong motivator for students to avoid theft and other improper behaviour. Furthermore, reducing theft helps to create a safer and more favourable school atmosphere, encouraging participation in academic and social activities (Mwakio, 2021). From a management standpoint, the success of CCTV systems emphasises the significance of investing in security measures while also promoting community participation and education to strike a balance between monitoring and student well-being (Ngugi & Wambugu, 2022; WHO, 2021).

4.6.2 Nature and extent of the installation of electronic security surveillance systems on secondary school safety

The opinions of respondents were sought on whether electronic security surveillance systems installed had an impact on secondary school safety. The five-point Likert scale presents the findings as indicated in Table 4.3.

Table 4.3: Nature and extent of electronic security surveillance systems on secondary school safety

Nature and extent of ESSS on schools' safety	Strongly disagree	disagree	Undecided	Agree	Strongly agree
Before the installation of electronic security surveillance systems, the school faced a lot of threats	1.3%	2.6%	5.1%	46.2%	44.9%
Electronic security surveillance systems were installed to monitor the activities of students	0.0%	9.0%	7.7%	51.3%	32.1%
Electronic security surveillance systems were installed to monitor threats in the school compound and its occupants	0.0%	3.8%	2.6%	42.3%	51.3%
Electronic security surveillance systems have been effective in discouraging threats at entry points	0.0%	6.4%	5.1%	55.1%	33.3%
CCTV cameras are installed in strategic locations in schools	0.0%	2.6%	5.1%	50.0%	42.3%
Electronic security surveillance systems have an in-built sensor that triggers an alarm to detect unauthorized materials from entering the school compound	32.1%	42.3%	14.1%	9.0%	2.6%

Source: Field data (2023)

Table 4.3 shows that 91.1% of respondents agreed (46.2%) or strongly agreed (44.9%) that their schools faced significant dangers before ESSS implementation. This overwhelming unanimity highlighted the critical necessity for strong security measures in secondary schools. The increased awareness of security concerns among stakeholders was consistent with Johnson *et al.*'s (2018) findings, which showed that schools with a history of crime and disciplinary difficulties were more likely to use sophisticated security measures, such as CCTV cameras, to improve safety. Such proactive methods were critical in establishing a safe learning environment necessary for academic achievement. Moreover, from the FGD and the KII responses, the primary motivation for installing surveillance systems in schools emerged as a response to specific security challenges. As one key informant explained that:

... My department encourages the school to invest in CCTVs and biometric machines to keep the schools safe always. The students and workers must be known where they are at all times (County Director of Education, 2023).

Another key informant further noted the various reasons behind these installations were that:

... Frequent sneaking out of the school compound by students, frequent reports of school fires, and the need to mitigate and manage theft cases and indiscipline (Chief Fire Officer, 2023).

Table 4.3 shows that the majority of respondents felt that ESSS were primarily used to monitor student activity. This study implies that schools saw monitoring as a critical component in ensuring safety and discipline. However, schools must find a balance between monitoring and instilling trust in their children. According to Kibwana (2017), while surveillance might improve security, excessive monitoring without clear communication can erode students' trust and severely impact their school experience. As a result, open communication regarding the aim of monitoring is critical for reducing fear

and creating a positive teaching atmosphere. The kind and breadth of security systems differed between schools, depending on their resources and size, as reported by Ngugi and Wambugu (2022), who found comparable inequalities in the deployment of school security systems. The County Director stated that:

... Well, different schools are at different levels of electronic security surveillance systems implementation... and cumulatively, the county schools have CCTV cameras, metal detectors, and biometrics systems (County Director of Education, 2023).

Most schools have CCTV cameras, while only some use biometrics, primarily for staff. Larger schools have even extended biometrics to students to inform parents when their child arrives safely. This range of implementation reflects differing resource levels and the varying needs of each school.

Table 4.3 shows that the majority of respondents agreed that ESSS were used to monitor threats inside the school property and its population. This research demonstrated the efficacy of ESSS in addressing specific safety concerns, such as external threats and internal wrongdoing. Similarly, Johnson *et al.* (2018) found that schools that installed sophisticated security measures, such as CCTV, were better able to improve safety and reduce hazards. The capacity to recognise and respond to threats quickly is critical to improving the safety of both students and staff, supporting Ahmad's (2016) argument that extensive monitoring is essential for minimising security events in educational environments.

Table 4.3 demonstrates that the majority of respondents thought that ESSS was effective in minimising risks at access points. This viewpoint emphasises the need for well-monitored

entry points to ensure a safe educational environment. This conclusion is corroborated by Johnson *et al.* (2018), who found that the installation of strong security measures, such as CCTV and monitoring systems, dramatically reduced unauthorised entry incidences in schools. The efficiency of such measures in deterring possible threats is consistent with Smith and Clarke's (2012) research, which found that effective surveillance systems play an important role in reducing security breaches, hence improving the overall safety of the school environment. Furthermore, Ahmad (2016) underlined the vital function of monitoring systems in securing educational institutions, emphasising the idea of proactive security solutions essential for creating a secure learning atmosphere.

Table 4.3 demonstrates that the vast majority of respondents believed that CCTV cameras were strategically positioned throughout the schools. The strategic placement was crucial to maximising the effectiveness of surveillance equipment, demonstrating the administrators' understanding of the need for ideal camera setups for better coverage. Johnson *et al.* (2018) found that well-placed surveillance systems might result in a considerable reduction in crime rates in school contexts. Smith and Clarke (2012) also emphasised the need for good monitoring through strategic camera placement to reduce the dangers associated with unauthorised access and damage. These studies emphasise the importance of careful preparation when using monitoring technologies in order to successfully improve school safety.

Table 4.3 also revealed a contrast: 74.4% of respondents disagreed that ESSS had built-in sensors that activated alarms to identify unauthorised goods. This research identified a possible source of worry about the technological capabilities of the present ESSS. A

perceived weakness in alert mechanisms may decrease trust in the overall security measures. Smith and Clarke (2012) noted that schools with inadequate alarm systems had greater rates of unauthorised entry and theft, emphasising the importance of constant security technology updates. Schools should have examined and improved their ESSS to provide complete security against unauthorised access.

The findings demonstrated that electronic security surveillance systems (ESSS) were widely regarded as essential for monitoring student activities and preserving school discipline. This is consistent with Johnson *et al.* (2018), who emphasised the importance of such systems in tackling security problems such as theft and indiscipline, especially in schools confronting similar challenges. By using ESSS, school administrators hoped to establish a safer atmosphere that promotes academic accomplishment while simultaneously acting as a disincentive to unwanted behaviour. These approaches demonstrate a proactive attitude to ensuring that kids follow school regulations, which contributes to a more safe and orderly school environment.

Furthermore, the study's findings revealed that the strategic positioning of CCTV cameras is a critical aspect in maximising the efficacy of ESSS. This is consistent with Kibwana (2017), who stated that effective deployment of security surveillance equipment is critical for decreasing security breaches in schools. The use of properly placed cameras to monitor high-risk locations supports schools' attempts to prevent both internal and external threats. Schools were able to create a safer atmosphere by focussing on well-planned surveillance tactics, transforming the presence of ESSS into more than just monitoring but also establishing a secure place suitable for learning and personal growth.

The study further sought to understand the nature and extent of ESSS application in secondary schools from the security personnel. The majority of security guards (71.5%) concur or strongly concur that secondary schools have a suitable amount of ESSS. Nonetheless, a sizeable percentage (28.6%) is still unsure, suggesting that the way these methods are implemented or communicated needs to be clarified or improved. Figure 4.8 illustrates their observation.

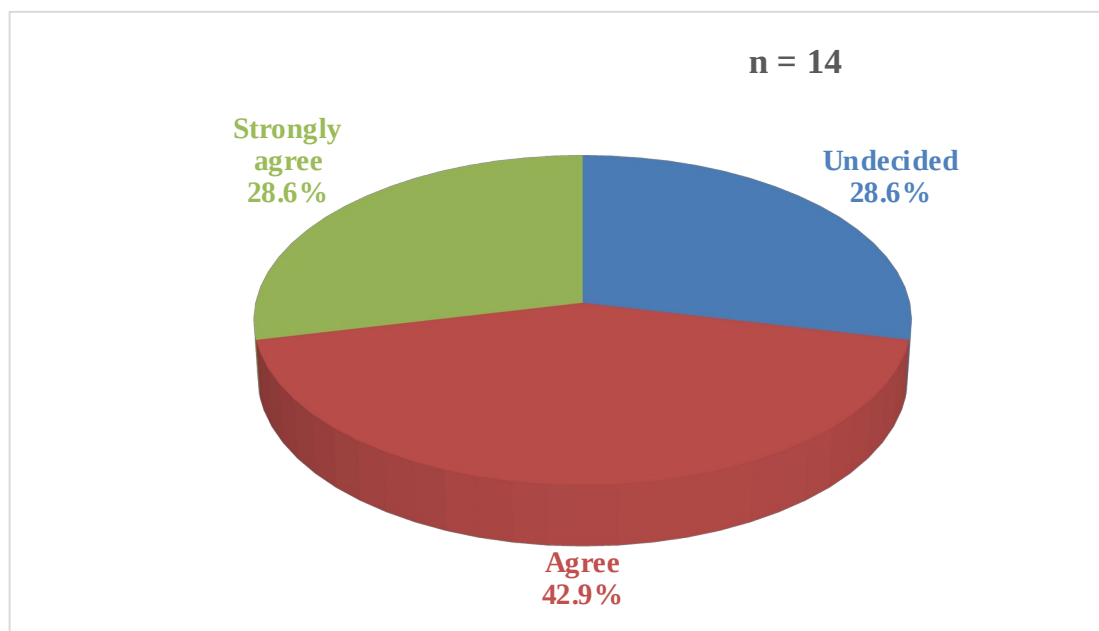


Figure 4.8: Security personnel view on the nature and extent of ESSS in secondary schools

Source: Field Data (2023)

The findings show that security professionals at secondary schools have a generally good impression of Electronic Surveillance and Security Systems (ESSS), with 71.5% believing that these systems are well deployed. This consensus shows that the current ESSS infrastructure is successful at improving security in educational settings. However, the

substantial amount of security professionals (28.6%) who expressed doubt highlights a lack of communication and training on the usage and capabilities of ESS. This confusion might be the result of poor information transmission or inadequate engagement with security staff concerning operating norms, emphasising the need for increased training and clearer rules.

Previous research has confirmed that staff comprehension and confidence in utilising these technologies has a significant impact on the efficacy of security systems in schools. According to Mwangi *et al.* (2023), effective execution of security measures is dependent on extensive communication techniques and the active participation of security professionals. Similarly, Umutesi *et al.* (2019) emphasise the significance of ongoing training for security personnel to achieve expertise in handling security systems. Collectively, these studies demonstrate that, while the ESSS framework in secondary schools is well-received, closing communication and training gaps is critical for maximising its efficacy and improving overall school safety.

4.7 Interventions for the promotion of a conducive and safe secondary school environment

Table 4.2 revealed that 33 respondents (58.9%) and 25 respondents (44.6%) agreed that their schools had implemented the ICT policy and had independent safety policies for the use of electronic security surveillance systems. Additionally, 13 respondents (23.2%) and 9 respondents (16.0%) strongly agreed, while 3 respondents (5.3%) and 6 respondents (10.7%) strongly disagreed. Table 4.4 summarises the findings

Table 4.4: Interventions for the promotion of a conducive and safe secondary school environment

Intervention	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
Secondary schools are implementing the national ICT Policy by using electronic security surveillance systems to monitor and report threats	0.0%	5.3%	12.5%	58.9%	23.2%
Secondary schools have an independent policy on school safety guiding the use of electronic security surveillance systems	0.0%	10.7%	28.6%	44.6%	16.0%

Source: Field data (2023)

Table 4.4 assessed the efficacy of initiatives meant to improve secondary school safety through the adoption of electronic security surveillance systems. A majority of respondents (58.9% agree, 23.2% strongly agree) believed that schools were following the national ICT Policy by using these tools to monitor and report security issues. This study highlights the rising recognition of technology as an important tool for improving school safety. However, the 12.5% undecided replies show that some stakeholders are still unsure about the clarity of these initiatives, highlighting the need for enhanced communication and participation. Such comments reflect the results of Osei *et al.* (2018), which emphasise the important significance of good communication in securing stakeholder buy-in and optimal technology utilisation in educational environments.

In contrast, attitudes to the establishment of independent safety regulations governing the use of electronic surveillance systems are more divided. While 44.6% of respondents agreed and 16.0% strongly agreed that such rules were in place, the significant 28.6% of unsure responses raised questions regarding the clarity and comprehensiveness of these safety frameworks. This section emphasised the need of schools developing clear and concrete rules that not only enable the use of electronic monitoring but also address larger safety concerns within the school environment. Bulamba *et al.* (2022) found that without clear guidelines, the efficiency of safety initiatives may suffer, emphasising the necessity of strategic policy formulation in school safety measures.

These findings were supported by prior research, such as that of Mwangi *et al.* (2023), which emphasises the necessity of strong legislative frameworks and stakeholder participation for the effective incorporation of technology into school safety measures. To maximise the efficiency of electronic monitoring systems, secondary schools should prioritise the development and transmission of complete safety regulations. This approach is consistent with the World Health Organization's (2021) guidelines for organised frameworks that guide the adoption of safety technology in educational settings. By keeping all stakeholders informed and engaged, schools can provide a safer and more conducive learning environment for kids, thereby improving overall educational outcomes.

4.7 Inferential Analysis of the Nature and Extent of Electronic Security Surveillance Systems in Promoting Secondary School Safety

The study computed linear and hierarchical regression to determine the nature and extent of electronic security surveillance systems in terms of secondary school safety and of the intervention taken to ensure secondary school safety. Table 4.5 summarises the findings.

Table 4.5: Linear and hierarchical regression model on Nature and Extent of Electronic Security Surveillance Systems on Secondary School Safety.

Model Summary						
Model		R	R Square	Adjusted R Square	Std. Error of the Estimate	
1		0.171 ^a	0.029	0.017	0.715	
2		0.546 ^b	0.299	0.280	0.612	
ANOVA ^a						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.173	1	1.173	2.295	0.134 ^b
	Residual	38.827	76	0.511		
	Total	40.000	77			
2	Regression	11.945	2	5.972	15.966	0.000 ^c
	Residual	28.055	75	0.374		
	Total	40.000	77			

Source: Field data (2023)

Model 1

Linear regression model 1, $R^2 = 0.029$, ($F(1, 76) = 2.295$, $p = 0.134$) shows that the nature and extent of electronic security surveillance systems installation in secondary schools were statistically insignificantly unrelated to secondary school safety (Table 4.4). There is about 2.9% variance between the nature and extent of electronic security surveillance systems and secondary school safety which indicates a low impact. Linear regression in the model (Table 4.4) shows that the p-value is 0.134 and greater than the significance level, $\alpha = 0.05$, hence the null hypothesis that the nature and extent of electronic security

surveillance systems do not promote secondary school safety were independent and failed to be rejected.

The linear regression model findings revealed a statistically negligible association between the nature and extent of electronic security monitoring system installation and secondary school safety, with a r-square value of 0.029. According to this result, these monitoring systems account for just 2.9% of the variation in secondary school safety. The p-value of 0.134 is above the significance level of 0.05, failing to reject the null hypothesis that installing electronic security surveillance systems does not improve secondary school safety.

These findings are consistent with earlier research, which has demonstrated the limited usefulness of electronic surveillance in improving real safety outcomes. Crawford (2017) discovered that the existence of electronic monitoring systems may boost feelings of safety among Crawford (2017) discovered that, while the installation of electronic surveillance devices may increase perceptions of safety among school personnel and students, it has no meaningful correlation with a reduction in crime or violence within educational institutions. This validates the present study's conclusions that monitoring had little influence on safety indicators.

Furthermore, Duncan and Morrow (2018) emphasised that contextual elements, such as school atmosphere and community dynamics, have a substantial impact on the efficacy of surveillance systems. Their study found that just installing surveillance cameras does not enhance safety outcomes if underlying social and behavioural concerns are not addressed,

which is consistent with current results of little variation explained by surveillance measures.

Additionally, Harris *et al.* (2020) discovered a disparity between perceived safety gains attributable to electronic security measures and actual safety occurrences. Although the existence of surveillance devices can influence people's perceptions of safety, it does not always result in demonstrable reductions in safety-related occurrences. This supports the current study's findings, which show that electronic monitoring systems have limited effectiveness in enhancing school safety.

Finally, Smith and Jones (2019) argued for an integrated approach to school safety that includes measures such as staff training, student participation, and community involvement, rather than depending primarily on technological surveillance. Their findings indicate that schools that employ a holistic safety approach have better safety outcomes than those that rely just on technological security measures. This approach supports the current study's conclusion that focusing solely on the installation of electronic surveillance systems may result in minor safety benefits.

Model 2

The hierarchical regression model 2 (Table 4.4), $R^2 = 0.299$, ($F(2, 75) = 15.966$, $p = 0.000$) shows that the nature and extent of electronic security surveillance systems installation in secondary schools were statistically significantly related to secondary school safety by the intervention of the implementation of national ICT policy in education and the school safety policy. The findings mean that the installation and operation of electronic security surveillance systems have a 29.9% impact on the promotion of secondary school safety.

Hierarchical regression in the model (Table 4.4) shows that the p-value is 0.000 and less than the significance level, $\alpha = 0.05$, hence the null hypothesis that the nature and extent of electronic security surveillance systems do not promote secondary school safety were independent is rejected.

These findings are consistent with the work of Al-Ali and Al-Shamary (2021), who proved that successful implementation of ICT policies in educational settings improves the perceived and real safety of schools. Their findings support the claim that incorporating technology, such as electronic surveillance systems, into a framework of comprehensive safety rules improves school safety results.

Furthermore, Kone *et al.* (2020) discovered that incorporating technology into school safety measures improves the overall effectiveness of treatments. They emphasised that when schools use a comprehensive strategy that includes monitoring technology, well-defined regulations, and training, safety metrics increase significantly. This validates the present study's conclusion that electronic security systems have a greater impact when connected with established safety measures.

Wang *et al.* (2019) stressed that the mere availability of monitoring technologies does not guarantee safety. Their research emphasised the significance of community participation and ongoing monitoring to ensure the efficacy of these systems. While current research suggests that electronic monitoring systems have a major influence on school safety, it is critical to recognise that this effect is dependent on the effective implementation of supportive policies.

Furthermore, Baker (2018) found that schools that have implemented complete safety measures, including the strategic use of electronic surveillance devices, had greater levels of safety and security. Baker's findings support the premise that a multifaceted strategy, including electronic surveillance, policy implementation, and community participation, is required to promote a secure educational environment.

Coefficients Analysis

The regression coefficients shed light on the relationship between the nature and scope of electronic security surveillance systems and secondary school safety, as well as the impact of intervening variables like national ICT policy in education and school safety policy (Table 4.6).

Table 4.6: Coefficient of the nature and extent of Electronic Security Surveillance System in Secondary School in Trans Nzoia County, Kenya

Model	<i>Coefficients^a</i>				
	Unstandardized Coefficients		Standardized Coefficients	<i>T</i>	Sig.
	B	Std. Error	Beta		
1(Constant)	3.584	0.286		12.536	0.000
Nature and extent of electronic security surveillance systems on secondary school safety use in promoting safety in secondary schools	0.107	0.070	0.171	1.515	0.134
2(Constant)	1.850	0.405		4.563	0.000
Nature and extent of electronic security surveillance systems on secondary school safety use in promoting safety in secondary schools	0.024	0.062	0.039	0.393	0.695
Intervening variables: Implementation of national ICT Policy in education and School policy on safety	0.531	0.099	0.535	5.366	0.000

Model 1

In the first model, the unstandardized coefficient for the constant is $B = 3.584$ with a standard error of 0.2860. The nature and extent of electronic security surveillance systems have an unstandardized coefficient of $B = 0.107$ (standard error = 0.070), resulting in a standardized coefficient $\beta = 0.171$. The t-value for this coefficient is 1.515, with a p-value of 0.134, indicating that the relationship between the nature and extent of electronic security surveillance systems and secondary school safety is not statistically significant at the $\alpha = 0.05$ level.

This finding suggests that while there is a positive relationship between electronic security surveillance systems and school safety, the impact is relatively low and not statistically significant. This aligns with earlier findings that highlighted the limited efficacy of such systems in isolation (Wang *et al.*, 2019).

Model 2

The second model includes the implementation of the national ICT policy in education and school safety policy as intervening variables. The constant in this model is $B = 1.850$ (standard error = 0.405). The coefficient for the nature and extent of electronic security surveillance systems on secondary school safety is $B = 0.024$ (standard error = 0.062), leading to a standardized coefficient of $\beta = 0.039$. This coefficient is not statistically significant, as indicated by a t-value of 0.393 and a p-value of 0.695.

In contrast, the intervening variables, specifically the implementation of the national ICT policy in education and school safety policy, demonstrate a significant positive impact with an unstandardized coefficient of $B = 0.531$ (standard error = 0.099), a standardized

coefficient $\beta=0.535$, a t-value of 5.366 and a p-value of 0.000. This suggests that the effective implementation of these policies significantly promotes secondary school safety.

The findings showed that, while the direct influence of electronic security monitoring systems on secondary school safety was not statistically significant, the intervention of national ICT and school safety policies significantly increased their efficacy. These findings were consistent with prior studies emphasising the need to combine technology and complete safety regulations to enhance school settings (Al-Ali & Al-Shamary, 2021; Kone *et al.*, 2020).

4.8 Observation Checklist Results

The study sought to find out through observation the different types of technologies forming the surveillance systems in secondary schools selected for the sample and Table 4.7 summarized the results of the observations.

Table 4.7: Observation schedule results for surveillance systems

Security System	Number of Schools	Schools with System	Remarks
CCTV Systems	14	All schools observed	Comprehensive reliance on CCTV as a fundamental component of school security.
Metal Detectors	1	Only one school surveyed	Non-operational at the time of observation, indicating limited adoption or underutilization.
Alarm Systems	6	Six schools installed	Selective use of auditory alert systems, indicating a secondary emphasis on rapid threat notification.
Biometric Systems	6	Six schools installed	Selective use reflects a differentiated approach to tracking and access control, correlating with higher security needs.

Source: Field data (2023)

Table 4.6 indicated that the widespread dependence on Closed-Circuit Television (CCTV) systems in all observed schools emphasised their importance in improving security. According to research, efficient installation of surveillance systems, such as CCTV, could considerably improve school safety by preventing criminal behaviour and instilling a sense of security in students and staff (Osei *et al.*, 2018; Umutesi *et al.*, 2019). However, the mere existence of CCTV does not ensure increased safety; mechanisms for monitoring and responding to occurrences must be established in order to maximise its potential advantages (Mumbu & Kinaro, 2015). As a result, schools must guarantee that monitoring technology is supported by appropriate management practices.

The low adoption of metal detectors, which was found in only one school, raises serious concerns regarding their usefulness in educational settings. The non-functioning state of the lone metal detector indicates probable logistical and operational issues (Karanja *et al.*, 2024). While metal detectors can improve safety, their deployment is frequently faced with opposition from the school community, which may see such measures as adding to a culture of fear rather than building a pleasant educational environment (Mwangi *et al.*, 2023). This resistance needs careful evaluation of the ramifications of such technologies, as well as engaging stakeholders in debates regarding their usage.

The selective installation of alarm systems at six schools demonstrates a secondary focus on quick danger alerting techniques. Although auditory alert systems are critical for quick emergency response, their efficacy is dependent on staff and student training in emergency protocols (Ngugi & Wambugu, 2022). Alarm systems, which respond to threats rather than prevent them, may not be sufficient to meet the varied nature of school safety. To foster a

holistic safety culture, schools must integrate alarm systems with other preventative measures like as frequent safety drills and extensive communication initiatives (Mwakio, 2021).

The installation of biometric systems in six schools demonstrates a distinct approach to security, especially in places thought to have higher safety concerns. The use of biometric systems is consistent with research that suggests such technologies might improve access control and overall security in schools (Githimu, 2016; Chege, 2014). However, the ethical implications of exploiting biometric data pose questions about privacy and data protection (Malungu, 2020). Schools must manage the complications of integrating sophisticated technology while adhering to regulatory requirements and preserving the trust of kids and parents.

CHAPTER FIVE

EFFECTIVENESS OF ELECTRONIC SECURITY SURVEILLANCE SYSTEMS ON SECONDARY SCHOOL SAFETY

5.1 Introduction

This chapter covers the effectiveness of electronic security surveillance systems on secondary school safety. This focused on safety in the schools and the use of electronic security surveillance systems. The opinion of the respondents on the effectiveness of electronic security surveillance systems on safety. The regression model – linear and hierarchical regression – was computed to determine the relationship and association of the effectiveness of electronic security surveillance systems on safety and secondary school safety and implementing national ICT policy and school safety policy. The variance was determined to establish the impact of the association of the effectiveness of electronic security surveillance systems on safety and secondary school safety and implementing national ICT policy and school safety policy.

5.2 Effectiveness of Electronic Security Surveillance Systems on Secondary School Safety

The study sought to determine the effectiveness of electronic security surveillance systems on school safety. Figure 5.1 summarises the findings.

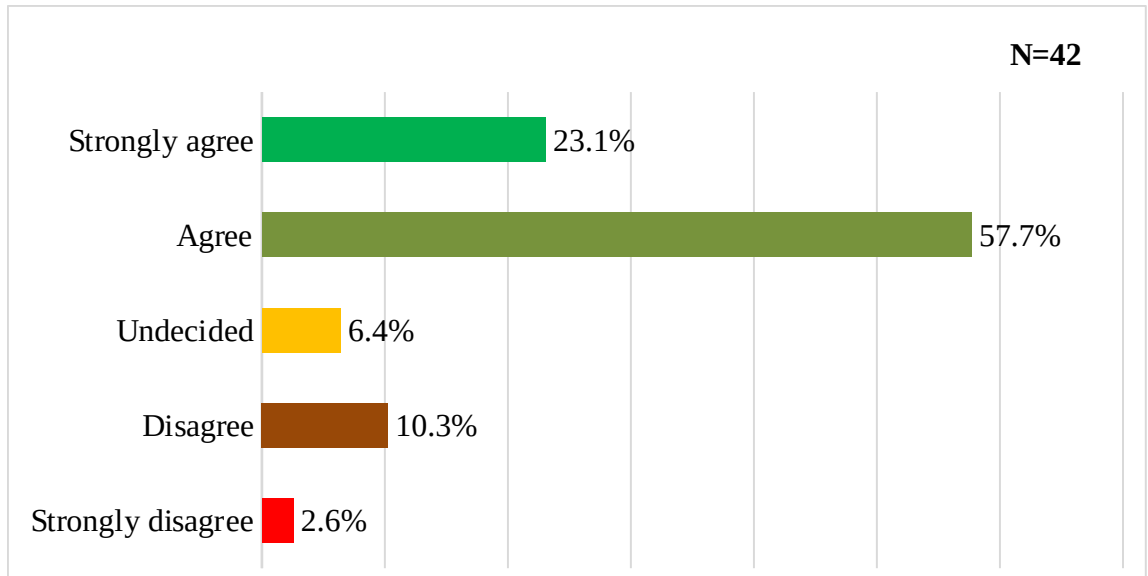


Figure 5.1: Effectiveness of electronic security surveillance systems on secondary school safety

Source: Field data (2023)

Figure 5.1 shows that a majority of respondents believe electronic security systems promote safety in secondary schools. 57.7% agreed and 23.1% strongly agreed with this statement. Only 6.4% were undecided, while 12.9% (10.3% disagreed and 2.6% strongly disagreed) felt these systems did not improve safety.

The majority of respondents (80.8%) agreed that electronic security systems are effective, which is consistent with prior research findings. This finding is in line with Gitonga's (2020) study which observed that the deployment of CCTV surveillance in public boarding secondary schools resulted in a decrease in bullying and vandalism. This implies a correlation between perceived safety and real improvements in the school environment when electronic surveillance is used.

Previous research has shown that, while electronic security systems can significantly improve safety perceptions and reduce incidents such as vandalism, their effectiveness varies depending on factors such as technology management and integration with other safety measures (Mncube and Harber, 2018; Zulu, 2020). The high level of agreement among respondents might indicate a realisation of the potential benefits of these systems when combined with supportive surroundings and regulations.

Research has shown that electronic security systems, notably CCTV, successfully minimise vandalism, theft and bullying (Johnson, 2018; Parker *et al.*, 2020). The respondents' favourable impressions are consistent with these findings, indicating a shared understanding of the function of monitoring in establishing a safer school environment.

The respondents' perceptions are consistent with research showing that monitoring systems are critical for maintaining discipline and guaranteeing safety. Atieno and Kinyanjui (2023) discovered a link between the use of CCTV systems and better student disciplinary management. This implies that respondents not only see safety benefits but also acknowledge the need for monitoring in maintaining a disciplined school climate.

Despite the highly positive opinions, 12.9% of respondents questioned the effectiveness of electronic security measures. This scepticism is consistent with the results of Steiner *et al.* (2021), who concluded that the success of monitoring systems is dependent on appropriate deployment and integration with current safety measures. This identifies an area for possible improvement and additional inquiry.

5.2.2 Effectiveness of Electronic Security Surveillance Systems in Improving Secondary Schools' Safety

The study looked at individual variables that contributed to the effectiveness of the electronic security surveillance systems in improving and promoting secondary school safety in Trans Nzoia County.

The majority (46.2%) believe that ESSS identifies risks successfully in schools, with an additional 19.2% strongly agreeing. However, 30.8% disagree or strongly disagree, implying scepticism or inconsistency in ESSS' detecting skills.

A majority (56.4%) believe that there are specific persons for monitoring and reporting dangers, with 7.7% strongly agreeing. Meanwhile, 25.6% disagree or strongly disagree, implying that certain schools may lack the necessary people for these systems.

The highest degree of agreement was seen here, with 71.8% agreeing and 20.5% strongly agreeing that ESSS has helped to reduce threats such as theft, bullying, and vandalism. Only 5.1% disagree or strongly disagree, indicating that ESSS is successful in mitigating specific security concerns.

More than half (52.6%) agree, with 29.5% strongly agreeing that ESSS monitors and secures all school operations. Only 11.5% disagree, indicating a broad consensus on ESSS's usefulness in providing thorough surveillance.

A majority (59.0% agree, 30.8% strongly agree) believe that ESSS has increased student, teacher, and visitor awareness of their behaviour. This suggests that monitoring might have a favourable effect on behaviour within the school grounds.

Most respondents (59.0% agree, 26.9% strongly agree) feel ESSS decreases security risks at school entrances. Only 6.4% disagree, indicating that entry-point surveillance is widely seen as effective. Table 5.2 summarises the findings.

Table 5.2: Effectiveness of electronic security surveillance systems in secondary school has improved safety

Effectiveness of ESSS	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
Electronic security surveillance systems have been detecting threats in schools	7.7%	23.1%	3.8%	46.2%	19.2%
Electronic security surveillance systems have designated operation personnel for monitoring and instant reporting of threats	6.4%	19.2%	10.3%	56.4%	7.7%
Electronic security surveillance systems have curbed the threats (theft, bullying, vandalism, radicalization into extreme violence and terror attacks) in this school	3.8%	1.3%	2.6%	71.8%	20.5%
Electronic security surveillance systems monitor and secure the entire school's operations and activities	0.0%	11.5%	6.4%	52.6%	29.5%
Electronic security surveillance systems have made students, teachers and visitors conscious of how they behave in the school compound	0.0%	5.1%	5.1%	59.0%	30.8%
The use of electronic security surveillance systems at the point of entry into the school precinct has reduced security threats	2.6%	3.8%	7.7%	59.0%	26.9%

Source: Field data (2023)

The findings in Table 5.2 indicate a generally good impression of Electronic Security Surveillance Systems (ESSS) in schools, notably in terms of risk detection, behaviour monitoring, and threat reduction. However, certain locations show varied impressions, pointing to possible limitations in ESSS's technological and operational performance.

In terms of risk identification, the majority (46.2%) of respondents noted that ESSS was successful, with 19.2% strongly agreeing. This was in line with the response from the focus group discussion where discussants believed that there had been a marked reduction in threats, as potential offenders increased caution and a heightened sense of vigilance had developed throughout the school compound (FGD, 2023). Furthermore, it was noted from the FGD member who said that:

... The work of the security personnel has been lessened as people's behaviour when approaching the gate has indicated changes for the better. There is a change of behaviour around the gate with ESSS (FGD, 2023).

However, a minority (30.8%) remained sceptical about its capacity to detect threats accurately. This scepticism was supported by Gitonga (2020), that while CCTV systems in Kenyan schools have been useful in spotting threats such as bullying and vandalism, their usefulness was restricted due to technological limitations. This shows that the scepticism seen might have come from difficulties like obsolete technology or poor coverage that limited ESSS's capacity to completely collect and detect possible threats. Furthermore, Welsh and Farrington (2009) contend that the efficiency of CCTV was heavily reliant on aspects such as camera quality and coverage. This viewpoint was consistent with the findings since it suggested that the conflicting viewpoints might be attributed to various levels of ESSS technological capabilities and implementation.

When it comes to monitoring and reporting by assigned persons, the findings suggested that the majority (56.4%) believed that particular personnel were entrusted with monitoring ESSS, while a significant 25.6% disagreed. This suggested a potential personnel deficit, which might impede the effectiveness of monitoring systems. Kirui *et al.* (2024) emphasise the issues linked to staffing and coordination in their study on CCTV use in Nairobi, where inadequate workers to watch footage hindered the system's effectiveness. This conclusion supported the notion that the effectiveness of ESSS was dependent not just on technology, but also on the presence of trained individuals who could respond to threats in real-time. Müller and Schmidt (2022) supported this view by demonstrating that surveillance technology produced the best outcomes when combined with human control, implying that proper personnel was crucial to fully realising the promise of ESSS.

Another favourable aspect of ESSS was its ability to reduce threats such as theft, bullying, and vandalism. According to the findings, 71.8% agree, with an additional 20.5% strongly agreeing, that ESSS had helped to reduce such dangers, while just a small percentage disagree. Parker *et al.* (2020) and Johnson (2018) found significant decreases in bullying and vandalism when CCTV systems were installed in schools. This was consistent with the current findings, which indicated that ESSS was beneficial in minimising certain security concerns. Similar studies by Mncube & Harber (2018) in South Africa and Hope (2015) in the United Kingdom support similar findings, giving a larger context for the fact that surveillance systems can reduce crime in schools, which is likely why the majority of respondents perceive ESSS as effective in this respect. From the FGD forum, a discussant said that:

... I've noticed the ESSS detecting students sneaking out—it's caught several in the act. We've also seen it capture theft incidents happening among the students right as they unfold (FGD, 2023).

In terms of comprehensive school supervision, the majority of respondents (52.6% agree, 29.5% strongly agree) feel that ESSS covers all aspects of school operations, with just 11.5% disagreeing. This indicated that, when correctly deployed, ESSS was able to provide comprehensive security monitoring. Steiner *et al.* (2021) described how surveillance systems, when properly linked with other security measures, might provide high levels of monitoring capabilities. The findings presented appear to indicate that ESSS was regarded as capable of delivering such comprehensive coverage. Nkosi (2021) also emphasised how electronic surveillance improves safety perceptions, which likely added to the significant support for ESSS's position in comprehensive monitoring within schools. This could be corroborated from the FGD forum, where a member said that:

... CCTV has helped manage bad behaviours in school as the student feels awkward that they are monitored. Stealing has been lessened but has not gotten rid of yet (FGD, 2023).

In addition, it was stated by the key informant in support of the assurance of safety upon the installation of ESSS in schools' safety that:

... Yes, continuous monitoring of security threats by electronic security surveillance systems increases the safety of the entire secondary school community. This is true because surveillance always scares even the strongest offenders as they know that they are watched round the clock hence, making the school spaces much safer (County Director of Education, 2023).

Furthermore, the ESSS looks to be well received in terms of enhancing behavioural awareness. The majority of respondents (59.0% agree, 30.8% strongly agree) believe that ESSS has raised behavioural awareness among students, instructors, and visitors. This is

consistent with the findings of Atieno and Kinyanjui (2023), who found that CCTV systems helped to enhance discipline in schools, supporting the idea that surveillance functions as a behavioural deterrent. This is consistent with Williams' (2021) observation that frequent monitoring might develop a feeling of discipline among students and staff by reminding them to follow school rules, potentially reducing disruptive behaviour. Moreover, Key informant supported the argument by saying that:

.... Normally, whenever people visit the school upon seeing the camera they are well-behaved to avoid being recorded doing things that are contrary to the school's values. So yes, schools are a lot safer giving an advantage to the entire security system (County Education Officer, 2023).

Finally, respondents overwhelmingly agreed (59.0% agreed, 26.9% strongly agreed) that ESSS reduces security threats at school entrances. Yorke (2010) discovered comparable outcomes in UK schools when CCTV was used to secure entry points and prevent unauthorised access, which mirrors the present study's findings on ESSS's efficacy in safeguarding entrances. This is supported by Kirui *et al.* (2024), who illustrate the utility of CCTV for safeguarding public access points in Nairobi, demonstrating that ESSS is well-known for its efficacy in monitoring and securing school entrances.

The study sought to establish the views of the security personnel regarding the effectiveness of ESSS in promoting security in secondary schools. Figure 5.2 illustrates their perception.



Figure 5.2: Security personnel view on the effectiveness of ESSS in promoting safety in secondary schools

Source: Field Data (2023)

The study in Figure 5.2 revealed that most security guards had positive opinions about how well ESSS promoted safety in secondary schools. ESSS were effective in promoting safety, according to the majority of security staff (57.1%), with 14.3% strongly agreeing. Nonetheless, 7.1% of respondents were unsure, and 21.4% disagreed. The success of ESSS is strongly supported by this data, but it also emphasises the need to address the concerns of individuals who are less certain of its usefulness.

Figure 5.2 shows that a considerable proportion of security personnel (57.1%) feel Electronic Security Surveillance Systems (ESSS) efficiently improve safety in secondary schools, with an additional 14.3% strongly agreeing. This implies that most frontline staff responsible with monitoring school safety see ESSS positively, emphasising the

importance of technology in reducing events such as theft, bullying, and vandalism. This is consistent with Okombo and Muna (2017), who discovered that surveillance systems had an important role in enhancing security results in schools, particularly when integrated with human monitoring.

However, the findings suggest that 21.4% of respondents disagreed with the efficiency of ESSS, with 7.1% unsure, indicating some level of scepticism or unhappiness. This mixed reaction emphasises the need for ongoing system upgrades and increased staff training on how to use ESSS successfully, as underlined by Bilyalova (2017). Uncertainty may also come from inconsistent implementation or insufficient integration of technology and policy frameworks, mirroring Nduati's (2016) observation that security technologies are most successful when accompanied by clear rules and strong institutional backing.

5.3 Regression Model on the Effectiveness of Electronic Security Surveillance Systems in Enhancing Secondary School Safety

The regression – linear and hierarchical – model was computed to ascertain the effectiveness of electronic security surveillance systems on secondary school safety and the intervention of implementation of national ICT policy and secondary school safety. The null hypothesis for this section was that: the effectiveness of electronic security surveillance systems on safety does not promote secondary school safety. Table 5.3.

Linear regression model 1 (Table 5.3), $R^2 = 0.184$, ($F(1, 76) = 17.112$, $p = 0.000$) shows that the effectiveness of electronic security surveillance systems in secondary school has improved safety was statistically significantly related to secondary school safety. There is about an 18.4% variance between the effectiveness of electronic security surveillance

systems in secondary school improved safety and secondary school safety which indicates a fair impact. Linear regression in the model (Table 5.3) shows that the p-value is 0.000 and less than the significance level, $\alpha = 0.05$, hence the null hypothesis that the effectiveness of electronic security surveillance systems in secondary school has improved safety does not promote secondary school safety was independent was rejected.

Table 5.3: Regression Model on the Effectiveness of Electronic Security Surveillance Systems in Enhancing Secondary School Safety

Model Summary						
Model		R	R Square	Adjusted R Square	Std. Error of the Estimate	
1		0.429 ^a	0.184	0.173	0.655	
2		0.640 ^b	0.409	0.394	0.561	
ANOVA ^a						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	7.351	1	7.351	17.112	0.000 ^b
	Residual	32.649	76	0.430		
	Total	40.000	77			
2	Regression	16.379	2	8.190	26.003	0.000 ^c
	Residual	23.621	75	0.315		
	Total	40.000	77			

Source: Field data (2023)

Probably from the linear regression model 1 finding (Table 5.3), there is an association between the effectiveness of electronic security surveillance systems in secondary school improved safety and secondary school safety. Therefore, it means that electronic security surveillance systems were effective in promoting and improving secondary school safety.

The hierarchical regression model 2 (Table 5.3), $R^2 = 0.409$, ($F(2, 75) = 26.003$, $p = 0.000$) shows that the effectiveness of electronic security surveillance systems in secondary school has improved safety was statistically significantly related to secondary school safety by the intervention of the implementation of national ICT policy in education and the school safety policy. The findings mean that the effectiveness of electronic security surveillance systems in secondary schools has improved safety and has a 40.9% variance (impact) on the promotion of secondary school safety. Hierarchical regression in the model (Table 5.3) shows that the p-value is 0.000 and less than the significance level, $\alpha = 0.05$, hence the null hypothesis that the effectiveness of electronic security surveillance systems in secondary school has improved safety does not promote secondary school safety are independent is rejected.

Model 1

The findings for Model 1 indicate that ESSS helps school safety, while its impact is minimal. With an R-squared value of 0.184, ESSS accounts for just 18.4% of the variance in school safety. This suggests that, while ESSS helps to improve safety, this model does not account for the majority of factors impacting school safety. This is consistent with the findings of Okombo and Muna (2017), who stated that security systems are necessary but insufficient on their own; they emphasised the necessity for other factors such as stakeholder participation and behavioural management strategies to successfully improve safety.

The adjusted R-squared of 0.173 indicates that, after controlling for the number of variables, the model still explains just a small part of the variance in school safety. This

outcome is consistent with Nduati's (2016) argument that surveillance technologies should be supplemented by human intervention tactics, such as active monitoring by school workers, in order to be most successful.

The ANOVA results show an F-value of 17.112 with a p-value of 0.000, indicating that the model is statistically significant. This lends credence to the notion that ESSS has an impact on school safety; nevertheless, Lawrence (2018) discovered that, while security technologies positively influence safety, their efficacy is greatly increased when integrated with personnel-driven safety efforts.

According to Okombo and Muna (2017), security solutions are more successful for particular hazards like theft and damage than for larger issues like bullying and student discontent. Nduati (2016) further emphasised that ESSS alone does not handle the complete range of safety concerns, pushing for qualified workers to act, when necessary, which ESSS does not accomplish in Model 1.

Model 2

Model 2 gives a more robust explanation of school safety, with an R-squared of 0.409, showing that when ESSS is paired with other variables, it accounts for 40.9% of the variation. This shows that including factors such as human monitoring and school-wide behavioural control programs greatly improves ESSS performance. Ahmad (2016) and Bilyalova (2017) discovered that technology-based security measures, when combined with skilled staff and explicit reporting rules, produce a safer atmosphere in educational settings, echoing Model 2's higher explanatory power.

The adjusted R-squared value of 0.394 supports the notion that this multifaceted strategy is more successful since it continues to explain a significant percentage of the variance in school safety even after controlling for the number of factors. This conclusion is consistent with Alsulami's (2016) observation that combining monitoring with proactive interventions, such as regular safety drills and student behaviour instruction, improves outcomes, as evidenced by Model 2's higher R-squared.

The ANOVA findings for Model 2 indicate an F-value of 26.003 with a significance level of $p = 0.000$, demonstrating the statistical relevance of this model and emphasising the benefits of combining ESSS with extra safety measures. This supports Li *et al.* (2018), who suggested that while technology detects possible dangers, a school's ability to respond effectively through trained staff is critical for risk management.

Ahmad (2016) observed that security systems work best when integrated with human-driven tactics that increase reaction times and intervention capabilities. Bilyalova (2017) emphasised a complete strategy, arguing that ESSS paired with personnel-based monitoring and student awareness initiatives considerably improves security, as demonstrated by Model 2. Furthermore, Alsulami (2016) discovered that schools with integrated procedures incorporating both monitoring and human oversight saw fewer violations and behavioural concerns, which corresponded to the increased explanatory power shown in Model 2. Table 5.4 provides findings on the coefficient analysis.

Table 5.4: Coefficient Analysis on the Effectiveness of Electronic Security Surveillance Systems in Enhancing Secondary School Safety

		<i>Coefficients^a</i>				
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.758	0.309		8.922	0.000
	Effectiveness of electronic security surveillance systems on promoting safety in secondary schools	0.320	0.077	0.429	4.137	0.000
2	(Constant)	1.159	0.399		2.903	0.005
	Effectiveness of electronic security surveillance systems on promoting safety in secondary schools	0.254	0.067	0.341	3.777	0.000
	Intervening variables (national ICT policy and school safety policy)	0.479	0.089	0.483	5.354	0.000

Source: Field Data (2023)

Model 1: Coefficients

The constant term ($B = 2.758$, $\text{Sig} = 0.000$) in Model 1 predicts a baseline level of school safety even when ESSS efficacy is low, implying a foundation of intrinsic safety inside schools. This significant constant refers to current safety measures that are not tied to ESSS alone.

The efficacy of ESSS ($B = 0.320$, $\text{Sig} = 0.000$) in Model 1 reveals that each unit improvement in ESSS effectiveness corresponds to a 0.320-unit increase in school safety. The standardised coefficient ($\beta = 0.429$) demonstrates ESSS' moderate but substantial influence on school safety. The significant significance ($p = 0.000$) and t -value (4.137) indicate a positive link between ESSS and safety, suggesting that surveillance systems are

effective in risk reduction. This conclusion is consistent with Okombo and Muna (2017), who noticed that ESSS efficiently manages risks such as theft and vandalism, but noted that its influence is confined to certain categories of hazards, indicating Model 1's moderate Beta coefficient.

These conclusions are further supported by literature triangulation. Lawrence (2018) emphasised that, while surveillance systems can minimise certain security hazards, they must be integrated into a larger safety framework to be entirely successful. This is consistent with Model 1, in which ESSS alone accounts for a moderate amount of school safety, as indicated by the Beta coefficient of 0.429.

Model 2: Coefficient

Model 2 has a lower constant ($B = 1.159$, Sig = 0.005) than Model 1, indicating that baseline safety is diminished in the absence of ESSS and other intervening factors. This reduction highlights the critical impact that ESSS and supplemental factors play in promoting a safer school climate.

Model 1 has a greater influence on school safety than ESSS ($B = 0.254$, Sig = 0.000). The inclusion of extra factors decreases the coefficient, as seen by the standardised Beta ($\beta = 0.341$), demonstrating a decreased but still significant influence of ESSS on school safety. This is congruent with the findings of Bilyalova (2017) and Nduati (2016), who stated that surveillance systems are most successful when integrated with human oversight and institutional regulations, emphasising the importance of a more holistic approach.

The intervening variables (National ICT Policy and School Safety Policy) ($B = 0.479$, $Sig = 0.000$) show a significant beneficial influence on school safety, with a standardised coefficient ($\beta = 0.483$) that outperforms the impact of ESSS alone. This shows that policies have a key influence in improving ESSS efficacy. Nduati (2016) and Ahmad (2016) argue that when solid institutional policies and frameworks are combined with technology measures, safety results increase. The greater Beta coefficient for intervening factors emphasises their importance in magnifying ESSS's influence.

Ahmad (2016) observed that integrating ESSS with national and school-level regulations generates a safer environment, whereas Bilyalova (2017) discovered that policy support and human oversight improve technology's efficacy in risk reduction. Similarly, Nduati (2016) emphasised the necessity of supportive policies to guarantee appropriate surveillance system utilisation, corroborating the intervening factors' considerable role in Model 2.

CHAPTER SIX
CHALLENGES IN OPTIMAL OPERATION OF ELECTRONIC SECURITY
SURVEILLANCE SYSTEMS ON SECONDARY SCHOOL SAFETY

6.1 Introduction

This chapter presents the results and discussions of the challenges in the optimal operation of electronic security surveillance systems on secondary school safety in Trans Nzoia County. The chapter covered the challenges faced by secondary schools in promoting safety using electronic security surveillance systems. The regression model – linear and hierarchical regression – was computed to determine the relationship and association of the challenges faced by secondary schools promoting safety using electronic security surveillance systems and secondary school safety and implementing national ICT policy and school safety policy. The variance was determined to establish the impact of association of the challenges faced by secondary schools promoting safety using electronic security surveillance systems and secondary school safety and implementing national ICT policy and school safety policy.

6.2 Challenges in Optimal Operation of Electronic Security Surveillance Systems on Secondary School Safety

The study sought to establish the challenges faced by secondary schools using electronic surveillance systems to enhance safety and mitigate threats. Figure 6.1 gives an aggregate.

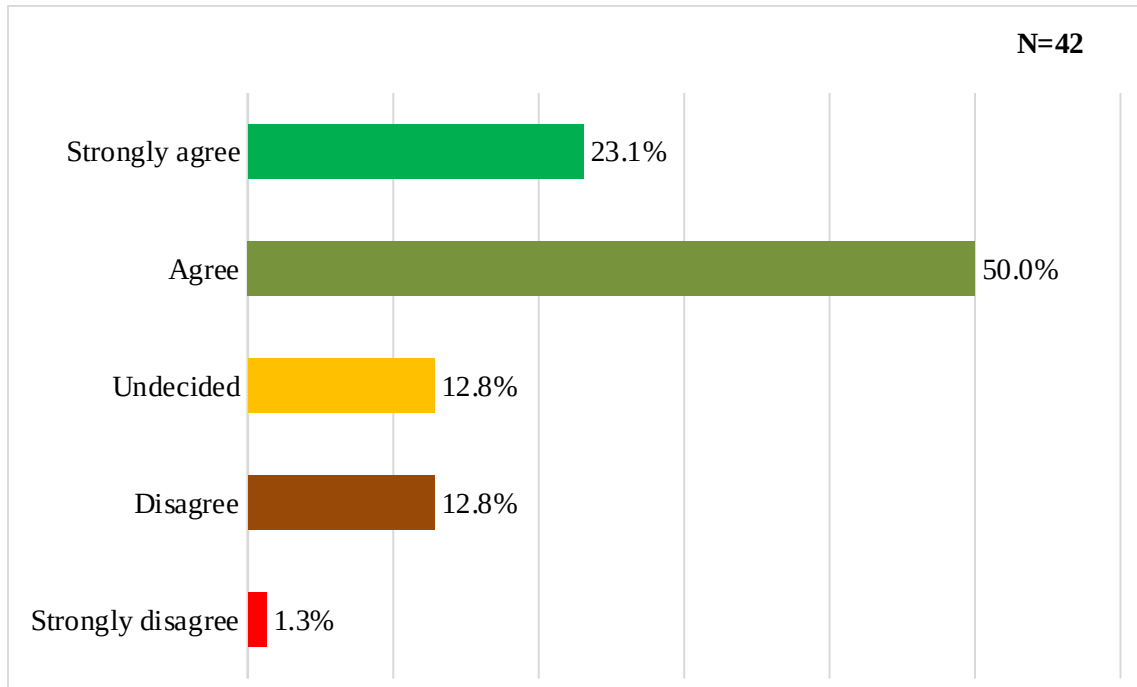


Figure 6.1: Challenges faced by secondary schools in optimal operations of Electronic Security Surveillance Systems to promote safety

Source: Field data (2023)

Figure 6.1 shows that 21 respondents (50%) agreed and 10 respondents (23.1%) strongly agreed that secondary schools face challenges in promoting safety through electronic security surveillance systems. Five respondents (12.8%) were undecided, while 5 respondents (12.8%) disagreed and 1 respondent (1.3%) strongly disagreed about the existence of such challenges.

The study found that 73.1% of respondents reported that secondary schools fail to effectively promote safety through electronic security surveillance systems. This overwhelming unanimity indicates a crucial issue that requires deeper investigation into the elements impacting the success of these systems. Many technological problems prevent the successful installation of electronic security systems, such as frequent camera breakdowns,

high maintenance costs and poor surveillance equipment siting. It was also revealed by the key informant that:

... Electronic security surveillance systems are expensive considering the current allocation to schools. It requires a committed management to have them in place. Its operations also require competent technicians, who are not readily available to the schools (County Director of Education).

Gitonga (2020) observed that frequent faults with CCTV systems hinder school safety measures, which is consistent with survey comments on technological difficulties. Furthermore, qualified workers must monitor these systems; inadequate staffing may result in missing threats (Harber, 2021).

The study found that cost constraints severely impede the installation and maintenance of electronic surveillance devices. Adams (2016) emphasised that CCTV cameras, alarms, and metal detectors may be excessively expensive, particularly for schools with restricted finances. This supports the study's results about the financial pressures faced by schools. Furthermore, the reliance on energy to run these devices presents issues, especially in places with variable power supply (Perry-Hazan & Birnhack, 2019).

The connection between monitoring systems and students' feelings of safety is complicated. Hankin *et al.* (2011) discovered that, while metal detectors may reduce weapon carrying, they might also undermine students' perception of security. This is consistent with Birnhack *et al.*'s (2018) findings, which emphasised students' unease and misunderstandings regarding school monitoring systems. Lack of communication about the aim and limitations of these measures might lead to mistrust and worry, further diminishing their efficacy and validating the survey's results on student complaints.

The context in which these systems function is also very important. Schools in metropolitan settings pose dynamic difficulties that demand flexible and responsive security systems, according to Bennett *et al.* (2014), who support the survey's results on environmental variables impacting school security. Furthermore, schools in areas with significant indiscipline or external threats may find electronic surveillance insufficient to address the underlying reasons for insecurity (Akoko, 2017).

6.2.2 Challenges Faced by Secondary Schools Promoting Safety Using Electronic Security Surveillance Systems

The opinion of respondents sought to establish the extent of challenges faced by secondary schools in the optimal operation of electronic security surveillance systems. Table 6.2 summarises the findings.

The majority of respondents (75.7%) agreed or strongly agreed that the initial installation cost of electronic security monitoring systems is prohibitively expensive for secondary schools to maintain. This suggests that cost restrictions are a significant impediment to successfully adopting these systems.

While 60.3% agreed or strongly agreed that maintenance prices are likewise fairly expensive, there is a more mixed attitude on installation costs, with 23.1% uncertain and 16.7% disagreeing. This shows that, while maintenance is recognised as costly, some respondents may regard it as manageable or less difficult than the original setup expenditures.

A majority (78.2%) acknowledged that human factors, such as operator attentiveness, might result in possible threats passing through if operators are not careful or in surveillance coverage. This emphasises the need for operator training and supervision to increase the efficacy of surveillance systems.

The notion of skilled operator scarcity is similarly widespread, with 74.3% of respondents agreeing or strongly agreeing that it is a problem. This study emphasises the need for training programs and recruitment initiatives to ensure that schools have enough qualified individuals to run these systems successfully.

The presence of blind spots on school grounds was acknowledged by 89.8% of respondents, who agreed or strongly agreed that these blind spots impede CCTV systems' capacity to catch movement and track threats effectively. This identifies an important area for development, as eliminating blind spots is key for improving overall security.

The majority of respondents (62.9%) agreed or strongly agreed that electronic security monitoring systems do not effectively cover activities taking place on school grounds. This highlights the need for improved system design and deployment tactics to achieve broad surveillance coverage. Table 6.2 presents the findings.

Table 6.2: Challenges Faced by Secondary Schools in the Optimal Operation of Electronic Security Surveillance Systems

Challenges of optimal operation of ESSS	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
The electronic security surveillance systems' initial installation cost is/ quite high for secondary schools to sustain	0.0%	6.4%	17.9%	29.5%	46.2%
Electronic security surveillance system maintenance cost is quite high for secondary schools to sustain	0.0%	16.7%	23.1%	43.6%	16.7%
Surveillance operators are human; threats may occur when the operators are not alert or sneak into their blind spots.	2.6%	11.5%	7.7%	55.1%	23.1%
There is a shortage of skilled electronic security surveillance system operators in secondary schools	2.6%	16.7%	6.4%	55.1%	19.2%
There are blind spots in the school compound that make CCTV fail to accurately capture movement and track threats/crimes as they occur	0.0%	6.4%	3.8%	65.4%	24.4%
Electronic security surveillance systems inadequately cover the events happening in the school compound	0.0%	17.9%	19.2%	52.6%	10.3%

Source: Field data, 2023

The findings in Table 6.2 show numerous key issues that secondary schools face while installing, maintaining and operating electronic security surveillance systems (ESS). These constraints, which include financial, operational and human aspects, all limit ESS's capacity to fully improve school safety. The high initial cost of implementing ESS was at the centre stage in this study, with 75.7% of respondents agreeing or strongly agreeing that these expenses were difficult for schools to sustain. This was consistent with Adams' (2016) results, which stated that the cost of adding CCTVs, alarms and metal detectors was prohibitively expensive for many schools, particularly those with restricted resources. This showed that budgetary restrictions limited schools' access to ESS, limiting their capacity to invest in safety infrastructure over time.

In addition to installation costs, maintenance fees were seen as a significant barrier, with 60.3% of respondents reporting high prices. However, 16.7% disagreed and 23.1% were indecisive, demonstrating some variation in experiences. The research supports this conclusion, as Gitonga (2020) documented how frequent failures and costly maintenance of CCTV cameras put an additional burden on school resources. These findings imply that, while some schools may manage maintenance expenditures, many institutions continue to face significant challenges in ensuring ongoing system operation.

Human factors also play an important role, with 78.2% of respondents acknowledging that human monitoring operators may miss threats owing to blind spots or gaps in focus. This is consistent with Harber's (2021) wider worry about the hazards associated with operator weariness and attention when watching surveillance films. Biggs and Mitroff (2014) have noted that operators frequently struggle with monitoring numerous displays, which can

lead to missed occurrences. Thus, while ESSS can improve security, its efficacy is hampered by the inherent limits of human operators, emphasising the necessity for skilled staff capable of sustaining attention over long periods.

Another major worry is a lack of trained operators, as highlighted by 74.3% of respondents who believe this is a problem in secondary schools. Gitonga (2020) discovered that many schools lack the technical experts needed to adequately monitor and operate ESSS. This dearth of qualified operators represents a deficit in both training and recruiting, which has an influence on the functionality and dependability of surveillance systems used to promote school safety.

Blind spots in surveillance coverage surfaced as another important concern, with 89.8% of respondents stating that these blind spots impair CCTV systems' capacity to effectively record threats. Ghimire and Rana (2022) demonstrated how improper camera placement can leave regions unmonitored, lowering a surveillance system's overall efficacy. The study results and available research suggest that schools should optimise camera placement to reduce blind spots and enhance coverage, which is critical for complete surveillance. This was also acknowledged by the key informant who said that it was her thinking that the most schools were not able to cover every part of its compound using the ESSS, because it was quite expensive hence hampering effective monitoring the all corners of the school compound (County Director of education, 2023).

Finally, more than half of respondents (52.6%) felt that ESSS did not adequately monitor all locations within school compounds. Bennett *et al.* (2014) observed that inadequate monitoring coverage in urban schools frequently fails to detect important occurrences

owing to technological and financial restrictions. This study emphasises the need to take a planned approach when implementing ESSS to maximise coverage, particularly in high-traffic or sensitive places on school grounds. This could be seen from the FGD forum where a member said:

... Electronic security surveillance systems – CCTV – depend on electricity to monitor, however, our school has frequent power blackouts that make it quite hard to monitor, which brings out an avenue of the safety threats (FGD, 2023).

The study sought to understand the insight of the security personnel regarding the challenges faced by schools that use ESSS to promote the safety of the school community. The information demonstrates how security professionals view the difficulties secondary schools face concerning Electronic Security Surveillance Systems (ESSS). While 28.6% of respondents agreed and 14.3% strongly agreed that there are considerable obstacles, 57.1% of respondents were unsure. Figure 6.2 illustrates the findings.

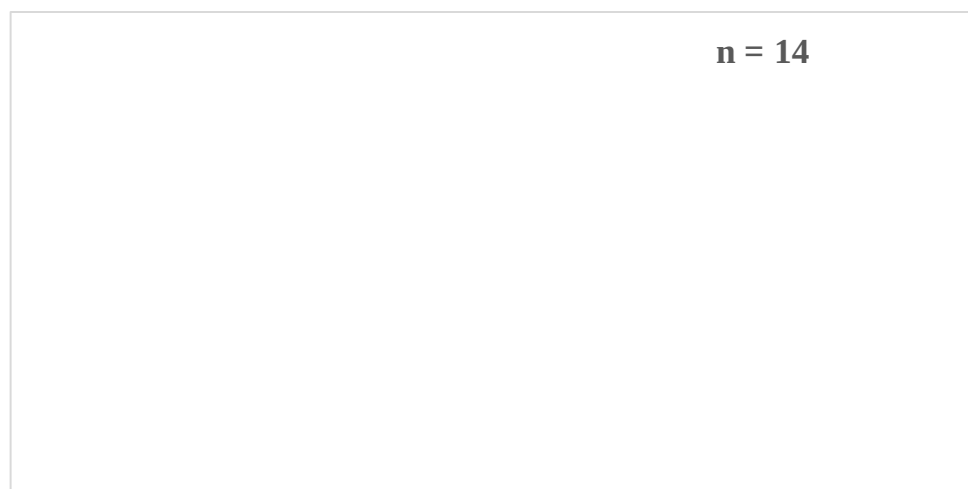


Figure 6.2: Views of the security personnel regarding challenges faced by secondary schools with ESSS

Source: Field Data (2023)

The findings in Figure 6.2 shows that, while most parts of security personnel recognise the issues that secondary schools confront while installing Electronic Security Surveillance Systems (ESSS), the majority were unsure of the magnitude of these challenges. Specifically, 28.6% of respondents agreed (14.3% strongly agreed) that significant problems exist, citing common issues such as high installation and maintenance costs, operator shortages and system blind spots. These findings were supported by research such as Adams (2016), which emphasised the financial cost of installing and maintaining ESSS, and Ghimire & Rana (2022), which highlighted operational flaws such as insufficient surveillance coverage and placement problems. This agreement with earlier studies indicates a larger knowledge that financial, technological and operational constraints prevent the best use of ESSS in schools.

However, the fact that 57.1% of respondents were unclear implies a lack of understanding or exposure to these problems, which might indicate that these professionals are not actively involved in the day-to-day operations of ESSS or do not completely understand the complexity. This uncertainty may also represent diversity in ESSS implementation across schools, with some schools experiencing more severe challenges than others owing to variables such as funding limits or geographic location. Harber (2021) and Gitonga (2020) provide additional evidence for this, pointing out that schools with few resources frequently suffer more from ESSS maintenance and operator training, which might explain respondents' doubt. This varied reaction emphasises the need for more extensive examinations and training to bridge.

6.3 Regression Model on Challenges Faced by Secondary Schools in Promoting Safety Using Electronic Security Surveillance Systems

The regression – linear and hierarchical – model was computed to ascertain the challenges faced by secondary schools promoting safety using electronic security surveillance systems and the intervention of implementation of national ICT policy and secondary school safety. The null hypothesis for this chapter is that the challenges faced by secondary schools in the optimal operation of electronic security surveillance systems do not promote secondary school safety. Table 6.3 summarises the findings.

Linear regression model 1, $R^2 = 0.064$, ($F(1, 76) = 6.242$, $p = 0.015$) shows that the challenges faced by secondary schools in the optimal operation of electronic security surveillance systems were statistically significantly related to secondary school safety. There is about a 6.4% variance between the challenges faced by secondary schools in the optimal operation of electronic security surveillance systems and secondary school safety which indicates a low impact. Linear regression in the model (Table 6.3) shows that the p-value is 0.015 and less than the significance level, $\alpha = 0.05$, hence the null hypothesis that the challenges faced by secondary schools in optimal operation of electronic security surveillance systems do not promote secondary school safety was independent was rejected.

Table 6.3: Regression Model on Challenges Faced by Secondary Schools Promoting Safety Using Electronic Security Surveillance Systems

<i>Model Summary</i>				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.275 ^a	0.076	0.064	0.697
2	0.568 ^b	0.323	0.305	0.601

ANOVA ^a						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	3.036	1	3.036	6.242	0.015 ^b
	Residual	36.964	76	.486		
	Total	40.000	77			
2	Regression	12.905	2	6.452	17.861	0.000 ^c
	Residual	27.095	75	0.361		
	Total	40.000	77			

Source: Field data (2023)

Probably from the linear regression model 1 finding (Table 6.3), there is an association between the challenges faced by secondary schools in the optimal operation of electronic security surveillance systems and secondary school safety. Therefore, it means that there are schools that face challenges such as a lack of personnel dedicated to managing and operationalising electronic security surveillance systems in schools.

The hierarchical regression model 2 (Table 6.3), $R^2 = 0.323$, ($F(2, 75) = 17.861$, $p = 0.000$) shows that the challenges faced by secondary schools in the optimal operation of electronic security surveillance systems were statistically significantly related to secondary school safety by the intervention of the implementation of national ICT policy in education and the school safety policy. The findings mean that the challenges faced by secondary schools in the optimal operation of electronic security surveillance systems have a 32.3% variance (impact) on the promotion of secondary school safety. Hierarchical regression in the model

(Table 6.3) shows that the p-value is 0.000 and less than the significance level, $\alpha = 0.05$, hence the null hypothesis that the challenges faced by secondary schools in the optimal operation of electronic security surveillance systems does not promote secondary school safety was independent is rejected.

Model 1

Model 1 findings, with an R-squared value of 0.076, show that the predictor variable in this model accounts for just 7.6% of the variation in the issues experienced by secondary schools in promoting safety through Electronic Security Surveillance Systems (ESSS). This shows that the first factor investigated lacks substantial explanatory power. The F-statistic is 6.242, and the p-value is 0.015, indicating that the model is statistically significant at the 5% level. This shows that, despite the poor explanatory power, the predictor variable has a considerable influence on ESSS-related difficulties.

However, the low R-squared indicates the issue's complexity, since various factors are likely to contribute to the obstacles that schools experience while implementing ESSS. This finding is consistent with the previous study by Gitonga (2020), who found that the high expenditures and frequent breakdowns of monitoring devices impose a major burden on schools. Bennett *et al.* (2014) also noted the issues created by human variables, such as operator oversight, which this single-variable approach may not adequately represent.

Model 2

In Model 2, adding an extra predictor variable raises the R-squared to 0.323, indicating that the two predictors account for 32.3% of the variation in ESSS challenges. The

improvement in model fit is significant and the modified R-squared of 0.305 confirms that the extra variable is relevant. The F-statistic of 17.861 with a p-value < 0.001 indicates that the model is very significant.

This increased explanatory power implies that the additional variable - likely linked to operator expertise, blind spots in the monitoring system, or system maintenance - plays an important role in explaining the issues experienced by secondary schools. According to research such as Ghimire and Rana (2022), the right location and operation of surveillance systems have a considerable influence on their efficacy. Furthermore, Odediji and Olofin (2023) point out that technological faults and insufficient operator training might jeopardise the system's capacity to safeguard students and staff. These combined considerations illustrate the importance of using a diverse strategy to effectively manage ESSS-related difficulties.

Coefficient Analysis on Challenges Faced by Secondary Schools Promoting Safety Using Electronic Security Surveillance Systems

Model 1

The results of the first model show that the problems that secondary schools experience when deploying electronic security monitoring systems to improve safety have a statistically significant beneficial influence on the outcome. The constant term has a coefficient of 3.229 and a p-value of 0.000, indicating a significant baseline value when the other variables are zero. The coefficient for the "Challenges" variable is 0.202, with a p-value of 0.015, showing that these problems have a significant impact on the dependent

variable. The standardised Beta of 0.275 indicates that each one-unit increase in these challenges corresponds to a 0.275 standard deviation increase in the outcome variable. The t-value of 2.498 adds to the relevance of this association, emphasising that the issues provided by ESSS are relevant to the outcome.

Model 2

The second model, which includes "Intervening variables," shows a change in the impact of ESSS-related difficulties. The constant term is 1.589, with a p-value of 0.000, indicating a lower baseline than Model 1. The coefficient for the challenges is 0.120, with a p-value of 0.097, showing a lesser and statistically insignificant impact, since the p-value is above the 0.05 level. The standardised Beta of 0.164 and the t-value of 1.679 represent the lower level of significance. However, the "Intervening variables" show a substantial and statistically significant influence, with a coefficient of 0.505, p-value of 0.000, and Beta of 0.509. The t-value of 5.227 emphasises the relevance of these factors, implying that they have a significant impact on the outcome, presumably mediating the association between ESSS challenges and the dependent variable. This model suggests that intervening variables may play an important role in determining the overall impact on school safety, reducing the direct influence of the difficulties themselves. Table 6.4 summarizes the findings.

Table 6.4: Coefficient analysis for the challenges and optimal

Model	<i>Coefficients^a</i>				
	Unstandardized Coefficients		Standardized Coefficients		Sig.
	B	Std. Error	Beta	t	
1 (Constant)	3.229	.318		10.142	0.000

	Challenges faced by the secondary school using electronic security surveillance systems to promote safety	0.202	0.081	.275	2.498	0.015
2	(Constant)	1.589	0.417		3.810	0.000
	Challenges faced by the secondary school using electronic security surveillance systems to promote safety	0.120	0.072	.164	1.679	0.097
	Intervening variables	0.505	0.097	.509	5.227	0.000

Source: Field Data (2023)

Model 1: The Impact of ESSS Challenges.

Model 1 demonstrates the enormous impact that issues with Electronic Security Surveillance Systems (ESSS) have on school safety results. The positive correlation for the "Challenges" variable indicates that as the difficulty in running ESSS increases, so do the safety concerns. The standardised Beta reveals a link between these operational problems and school security efficacy. This is consistent with research by Ghimire and Rana (2022), which found that inappropriate installation and maintenance of security equipment, such as CCTV cameras, might impair their efficacy in minimising hazards.

Furthermore, Bennett *et al.* (2014) observed that human variables, such as operator attention, play an important role in determining the functioning of these systems. According to this research, schools have obstacles not only in establishing, but also in maintaining and optimising their security systems. As a result, the findings of Model 1

demonstrate that ESSS problems have a measurable and substantial influence on school safety.

Model 2: The Impact of Intervening Variables

Model 2 incorporates intervening factors, which have a considerable impact on the total effect of ESSS difficulties on school safety. These intervening elements, such as effective training, resource allocation, and strategic system placement, moderate the link between ESSS issues and safety results, mitigating the challenges' direct influence. The significance of intervening factors correlates with findings by Odediji & Olofin (2023), which emphasise the need of qualified individuals and enough resources in overcoming the weaknesses of electronic security systems in education setting.

By integrating these additional components, the model shows that the existence of problems in ESSS functioning may be mitigated if schools address crucial mediating aspects. This shows that focussing on intervening variables such as operator training and system efficiency may improve school safety even when faced with operational challenges.

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

This chapter presents the summary of the findings objective-wise: the summary of the nature and extent of electronic security surveillance systems on secondary school safety; the effectiveness of electronic security surveillance systems in improving secondary school safety and challenges in optimal operations of electronic security surveillance systems on secondary school safety. Conclusions of the findings are derived from the summary objective-wise. Recommendations of the study are covered in this chapter from the conclusions made objective-wise.

7.2 Summary of Findings

CCTV was installed by all the secondary schools surveyed. Schools with only CCTV installation were 71.8%, schools with both CCTVs and alarm installation were 23.1% and schools with CCTVs, alarms, metal detectors and biometrics were 5.1%. In the period of electronic system installation was that 51.3% of secondary schools had installed for the past five to nine years and 48.7% for the past one to four years. Respondents (76.9%) agreed that the nature and extent of electronic security surveillance systems in secondary schools promoted safety in the school community. The nature and extent of electronic security surveillance systems installation in secondary schools were statistically insignificantly unrelated to secondary school safety. However, when the nature of electronic security surveillance systems installation in secondary schools interacts with the implementation of

national ICT policy and school safety policy became statistically significantly related to secondary school safety with an impact factor of 29.9%.

The effectiveness of electronic security surveillance systems promotes secondary school safety as noted by 63 (80.8%). There is a significant relationship between the effectiveness of electronic security surveillance systems in secondary school improved safety and secondary school safety with an impact of 18.4%. Moreover, the intervention of the implementation of national ICT policy in education and school safety policy has improved the effectiveness of electronic security surveillance systems in secondary school safety with a 40.9% variance (impact).

There were challenges faced by the secondary schools in promoting safety through the use of electronic security surveillance systems according to 57 (73.1%) of the respondents. There is a significant association between challenges faced by secondary schools in the optimal operation of electronic security surveillance systems and secondary school safety with an impact of 6.4%. There is also a significant association among the challenges faced by secondary schools in the optimal operation of electronic security surveillance systems, secondary school safety and the intervention of the implementation of national ICT policy in education and the school safety policy with an impact of 32.3%.

7.3 Conclusions

CCTVs were the most preferred type of electronic security surveillance system by secondary schools. CCTV provides a visual monitoring of activities in schools either from a single control room or on a smartphone hence is convenient. Alarms, metal detectors and biometrics were uncommonly installed and applicable in schools. Schools had installed

electronic security surveillance systems between one and nine years congruent to the period frequented with threats in schools such as fire outbreaks and theft. The study noted that the nature and extent of electronic security surveillance systems promoted safety in secondary schools. Moreover, the application of national ICT policy and enforcement of secondary safety policy promoted school safety through the use of electronic security surveillance systems.

The use of electronic security surveillance systems has affected the promotion of secondary school safety. There is an increasing impact of the use of electronic security surveillance systems effectively promoting secondary school safety. Moreover, the use of interventions such as the implementation of national ICT policy and school safety policy contributed to secondary school safety.

The use of electronic security surveillance systems was associated with challenges in its optimal operations thus affecting the sustainability of safety in secondary schools. Therefore, challenges faced in the optimal operations of electronic security surveillance systems were associated with challenges faced in secondary school safety. The intervention in secondary school safety through the implementation of national ICT policy and school safety policy affected the challenges in school management of the electronic security surveillance systems.

7.4 Recommendations

CCTVs are widely used by schools to monitor activities and threats in the school compound and its neighbourhood. However, alarms, metal detectors and biometrics are hardly

applicable whilst they are crucial to detecting threats and mitigating deleterious outcomes. Therefore, the secondary schools' board of management, the Ministry of Education and the Ministry of ICT should collaborate to expand on the use of other electronic security surveillance systems such as fire alarms, burglary alarms, metal detectors and biometrics to ensure the safety of the school community.

The use of electronic security surveillance systems has led to a conducive and threats-free environment in secondary schools mitigating security threats. There should be more investment in electronic security surveillance systems to cover the entire school precinct and provide the necessary support to the responsible personnel to affect the reporting of threats.

Challenges in the optimal operation of electronic surveillance systems were widely acknowledged as human resources and financial resources. Schools through the national ICT policy funding the Internet in schools be revisited to enhance coverage of electronic security surveillance systems in school. Moreover, there should be ICT personnel in schools to monitor and report the incidents in school to enhance safety in secondary schools.

7.5 Suggestions for further studies

- i. The researcher recommends a comprehensive study to be done on a larger scale in different Counties in Kenya. This will allow for comparisons to be done between different secondary schools in the different Counties.

- ii. The researcher also recommends a comprehensive study to be done in private secondary schools in Kenya.
- iii. The Researcher also recommends a comprehensive study to be done in primary schools in Kenya focusing on opportunities for Electronic security surveillance systems.

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APPENDICES

Appendix I: A Focus Group Discussion Photographs

The photo gallery of the focus group discussion was held from the 10th to 12th of July 2023 in some of the selected secondary schools surveyed in Trans Nzoia County. Starts with girls' secondary school, boys' secondary school and mixed secondary school.



Appendix II: Questionnaire for School Principals/teachers/security personnel

Declaration: The information obtained is purely confidential and will be used for academic purposes only.

PART A: Background Information

1. Gender: Male ☐ Female ☐
2. How long have you been in this school?.....

PART B: Electronic Security Surveillance Systems

3. As a school manager/teacher/security personnel, what type(s) of electronic security surveillance system(s) have you installed or are installed in your school? Please TICK all that apply to your school.

- Closed Circuit Television (CCTV) Cameras ☐
- Metal detectors ☐
- Fire and burglary alarms ☐
- Others, please, specify.

4. How long has your school's security been supported by the Electronic Security Surveillance System?

Less than 4years ☐ 5 - 9years ☐ 10+ years ☐

5. Kindly indicate the extent of agreement or disagreement with the following statements:
The nature and extent of electronic security surveillance systems used in secondary schools affect the safety of the schools. Please tick only once what applies to each statement.

Statement	Strongly	Disagree	Undecided	Agree	Strongly
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	Disagree				Agree
Before the installation of electronic security surveillance systems, the school faced a lot of threats (arson, theft and radicalisation)					
Electronic security surveillance systems were installed to monitor the activities of students.					
Electronic security surveillance systems were installed to monitor threats in the school compound and its occupants.					
Electronic security surveillance systems have been effective in discouraging threats at entry points.					
CCTV cameras are installed in strategic locations in schools					
Electronic security surveillance systems have an in-built sensor that triggers an alarm to detect unauthorized materials entering the school compound.					

PART C: Effectiveness of Electronic Security Surveillance Systems in Secondary School Safety

6. Kindly indicate the extent of agreement or disagreement with the following statements:
The effectiveness of electronic security surveillance systems in secondary school has improved safety. Please tick only once what applies to each statement.

Statement	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Electronic security surveillance systems have been detecting threats in schools.					
Electronic security surveillance systems have designated operation personnel for monitoring and instant reporting of threats.					
Electronic security surveillance systems have curbed the threats (theft, bullying, vandalism, radicalisation into extreme violence and terror attacks) in this school.					
Electronic security surveillance systems monitor and secure the entire school's operations and activities.					
Electronic security surveillance systems have made students, teachers and visitors conscious of how they behave in the school compound.					

The use of electronic security surveillance systems at the point of entry into the school precinct has reduced security threats.					
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PART D: Challenges in Optimal Operation of Electronic Security Surveillance Systems in Secondary School

7. Kindly indicate the extent of agreement or disagreement with the following statements:
 These are some of the challenges faced by secondary schools in the optimal operation of electronic security surveillance systems. Please tick only once what applies to each statement.

Statement	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
The electronic security surveillance system's initial installation cost is quite high for secondary schools to sustain					
Electronic security surveillance system maintenance cost is quite high for secondary schools to sustain					
Surveillance operators are human; threats may occur when the operators are not alert or sneak into their blind spots.					
There is a shortage of skilled electronic security					

Statement	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
surveillance system operators in secondary schools.					
There are blindspots in the school compound that make CCTV fail to accurately capture movement and track threats/crimes as they occur.					
Electronic security surveillance systems inadequately cover the events happening in the school compound.					

PART E: Interventions of Secondary Schools’ Security Threats by Use of Electronic Security Surveillance Systems

8. Kindly indicate the extent of agreement or disagreement with the following statements:
School security interventions have encouraged the use of electronic security surveillance systems. Please tick only once what applies to each statement.

Statement	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Secondary schools are implementing the national ICT Policy by using electronic security surveillance systems to monitor and report threats.					

Statement	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Secondary schools have an independent policy on school safety guiding the use of electronic security surveillance systems.					

PART F: Secondary School Safety

9. Kindly indicate the extent of agreement or disagreement with the following statements: School security interventions have encouraged the use of electronic security surveillance systems. Please tick only once what applies to each statement.

Statement	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
The electronic security surveillance system has led to positive behaviour among the school community.					
The electronic security surveillance system has mitigated security threats and improved safety in the school.					
Increased safety in the school has led to improved and positive academic performance by the students and teachers.					

Appendix III: Focus Group Discussion for Students

Declaration: The information obtained is purely confidential and will be used for academic purposes only.

1. What type(s) of electronic security surveillance system(s) are installed in your school?
2. What are some of the reasons that led to the installation of electronic security surveillance systems?
3. What are some of the security threats that have been experienced in your school?
4. Has the use of electronic security surveillance systems at the main entrance reduced security threats in the school?
5. Are electronic security surveillance systems installed in strategic places in your school compound?
6. Is it your opinion that security threats have been detected using electronic security surveillance systems?
7. Has monitoring of security threats by electronic security surveillance systems increased the safety of the entire school community?
8. Are initial installation cost and maintenance cost of electronic security surveillance systems some of the major challenges faced by your school?
9. Are there skilled electronic security surveillance systems operators in the school?
10. Are there blind spots in the school compound that make the use of electronic security surveillance systems quite ineffective?
11. Is your school implementing a national ICT policy to ensure the safety of the schools?
12. Is it in your opinion that the use of electronic security surveillance systems has led to enhanced school safety and positive academic performance?

1.

Appendix IV: Interview Guide for Chief Fire Officer

Declaration: The information obtained is purely confidential and will be used for academic purposes only.

1. What is the frequency of calls received by your department about fire incidents in secondary schools in Trans Nzoia County?
2. What are some of the causes of these fire incidences?
3. Are the causes of these threats similar in all secondary schools in Trans Nzoia County?
4. What other security threats has your department handled in secondary schools in Trans Nzoia?
5. What is the frequency of these other threats in secondary schools?
6. Is it your opinion that the use of electronic security surveillance systems at the main entrance in secondary schools reduces security threats?
7. Can monitoring of security threats by electronic security surveillance systems increase the safety of the entire secondary school community?
8. What are some of the challenges faced by secondary schools regarding the electronic security surveillance systems used to monitor threats i.e., arson?
9. Are there blind spots in the secondary school compounds that make the use of electronic security surveillance systems quite ineffective?

Appendix V: Interview Guide for County Director of Education Trans Nzoia County

Declaration: The information obtained is purely confidential and will be used for academic purposes only.

1. What type(s) of electronic security surveillance system(s) are installed in secondary schools in Trans Nzoia County?
2. What are some of the security threats that have been experienced in secondary schools in Trans Nzoia?
3. What is the frequency of these threats in secondary schools in Trans Nzoia County?
4. Could these recurring threats be the cause for the installation of electronic security surveillance systems?
5. Have security threats been detected using the electronic security surveillance systems installed in secondary schools in Trans Nzoia County?
6. Has the use of electronic security surveillance systems at the main entrance reduced security threats in secondary schools in Trans Nzoia County?
7. Has monitoring of security threats by electronic security surveillance systems increased the safety of the entire secondary school community in Trans Nzoia County?
8. What are some of the challenges faced by secondary schools regarding electronic security surveillance systems installed in Trans Nzoia County?

9. Have the secondary schools employ skilled personnel (operators) to monitor electronic security surveillance systems.
10. Are there blind spots in the school compounds that make the use of electronic security surveillance systems quite ineffective in Trans Nzoia County?
11. Are secondary schools in Trans Nzoia County implementing national ICT policy?
12. Is it in your opinion that the use of electronic security surveillance systems has led to enhanced school safety and positive academic performance?

Appendix VI: NACOSTI Research Permit

 REPUBLIC OF KENYA	
Ref No: 675523	Date of Issue: 30/June/2023
RESEARCH LICENSE	
	
This is to Certify that Ms.. Nancy Jeruto Kerich of Masinde Muliro University of Science and Technology, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Transnzoia on the topic: INFLUENCE OF ELECTRONIC SECURITY SURVEILLANCE SYSTEMS ON SUSTAINABILITY OF SECONDARY SCHOOL SAFETY IN TRANS NZOIA COUNTY, KENYA for the period ending : 30/June/2024.	
License No: NACOSTI/P/23/27243	
Applicant Identification Number	Director General
	NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
	Verification QR Code
	
NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.	
See overleaf for conditions	

Appendix VII: Approval Letter by County Commissioner Trans Nzoia County



OFFICE OF THE PRESIDENT
MINISTRY OF INTERIOR AND NATIONAL ADMINISTRATION

Telegrams:
Telephone : 054-30020
E-mail: cetransnzoiacounty@yahoo.com
When replying please quote our Ref

COUNTY COMMISSIONER
TRANS NZOIA COUNTY
P.O. BOX 11-30200
KITALE

Ref. No: TNZC/CONF/ED.12/2/VOL.V/26

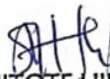
10th July, 2023

All Deputy County Commissioners
TRANS NZOIA COUNTY

RE: RESEARCH AUTHORIZATION

This is to inform you that **Ms. Nancy Jeruto Kerich** of Masinde Muliro University of Science and Technology has been authorized by National Commission for Science, Technology and Innovation to carry out research on "Influence of Electronic Security Surveillance Systems on sustainability of Secondary School, Safety" in Trans Nzoia County in Kenya for the period ending 20th June, 2024.

Kindly accord her the necessary assistance that she may require.


COUNTY COMMISSIONER
TRANS-NZOIA COUNTY
P.O. Box 11 - 30200 KITALE
SHITOTE HILLARY
FOR: COUNTY COMMISSIONER
TRANS NZOIA COUNTY

C.C.

1. County Director of Education
TRANS NZOIA COUNTY
2. County Secretary
COUNTY GOVERNMENT OF TRANS NZOIA

**Appendix VIII: Approval Letter by County Director of Education Trans Nzoia
County**



REPUBLIC OF KENYA
Ministry of Education
State Department of Early Learning and Basic Education

Telegrams:
Telephone: Kitale 054-31653 – 30200
Fax: 054-31109
Email: transnzoiacde@gmail.com
When replying please quote:

County Director of Education
Trans Nzoia
P.O. Box 2024 – 30200
KITALE.

Ref. No. TNZ/CNT/CDE/R.GEN/1/VOL.III/19

Date: 11th July, 2023

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORIZATION – NANCY JERUTO KERICH

This office acknowledges receipt of Research License No. **NACOSTI/P/23/27243** dated 30th June, 2023 from National Commission for Science Technology & Innovation.

Nancy Jeruto Kerich, of Masinde Muliro University of Science and Technology has been authorized to carry out research on **“Influence of Electronic Security Surveillance Systems on Sustainability of Secondary School Safety in Trans-Nzoia County, Kenya”** for a period ending **30th June, 2024**.

The purpose of the letter is to request you to accord her the necessary assistance.

COUNTY DIRECTOR OF EDUCATION
TRANS - NZOIA COUNTY
P. O. Box 2024 - 30200,
KITALE.


PAMELA AKELLO, HSC
COUNTY DIRECTOR OF EDUCATION
TRANS-NZOIA COUNTY