CHRISTIAN SERVICE UNIVERSITY COLLEGE

ASSESSMENT OF THE UTILIZATION OF MOBILE DATA COLLECTION TECHNOLOGY IN MONITORING AND EVALUATION IN THE EDUCATION SECTOR: A CASE STUDY OF GHANA EDUCATION SERVICE – NSAWAM/ADOAGYIRI MUNICIPALITY

DERRICK KOFI BOADU

2023

CHRISTIAN SERVICE UNIVERSITY COLLEGE

ASSESSMENT OF THE UTILIZATION OF MOBILE DATA

COLLECTION TECHNOLOGY IN MONITORING AND

EVALUATION IN THE EDUCATION SECTOR: A CASE STUDY OF

GHANA EDUCATION SERVICE – NSAWAM/ADOAGYIRI

MUNICIPALITY

BY

DERRICK KOFI BOADU

(16001021)

A DISSERTATION SUBMITTED TO THE DEPARTMENT OF

PLANNING AND DEVELOPMENT OF THE FACULTY OF

HUMANITIES, CHRISTIAN SERVICE UNIVERSITY COLLEGE, IN

PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE

AWARD OF A MASTER OF SCIENCE DEGREE IN MONITORING

AND EVALUATION.

AUGUST 2023

DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate Signature …….……………..   Date: …20/10/2023…………

Name: Derrick Kofi Boadu

Supervisors' Declaration

We hereby declare that the preparation and presentation of the dissertation were supervised per the guidelines on the supervision of the dissertation laid down by Christian Service University College.

Supervisor's Signature …………………….. Date: ………………………….

Name: Mr. Kwame Poku-Antwi

ABSTRACT

In recent years, the growing importance of Mobile Technology has had a significant impact on various aspects of human life, including education. The adoption of Mobile Data Collection techniques has become a powerful tool to revolutionize educational practices, enabling educational institutions to make data-driven decisions that support improved outcomes. This research explores the Assessment of the utilization of Mobile Data Collection in GES: A case study of Nsawam/Adoagyiri Municipality. The methodology employed in this research was both qualitative and quantitative since close-ended and open-ended questions were administered. Since the research resorted to the use of Mobile Data Collection, a remote server was designed to host the data collected. After data collection, the data was downloaded from the online server to a local storage system where data cleaning was done. Microsoft Excel application was used for the data analysis and interpretation. The survey found that the usage of MDC technology in GES was very minute since there was the usage of Excel templates and Paper-based means of collecting data. Again, officers at some levels in charge of Data Collection and Analysis had no access to budget allocation for their M&E activities. Upon the results collected and collated from the research, the researcher recommended that there be the composition of a functioning M&E system within the Education Directorate, the appointment of the required officers with the technical know-how and also have the budgetary allocation for their Mobile Data Collection activities.

KEYWORDS

Mobile Data Collection

Terms of Reference

Non-Governmental Organizations

Data Collection

Monitoring and Evaluation

Personal Digital Assistants
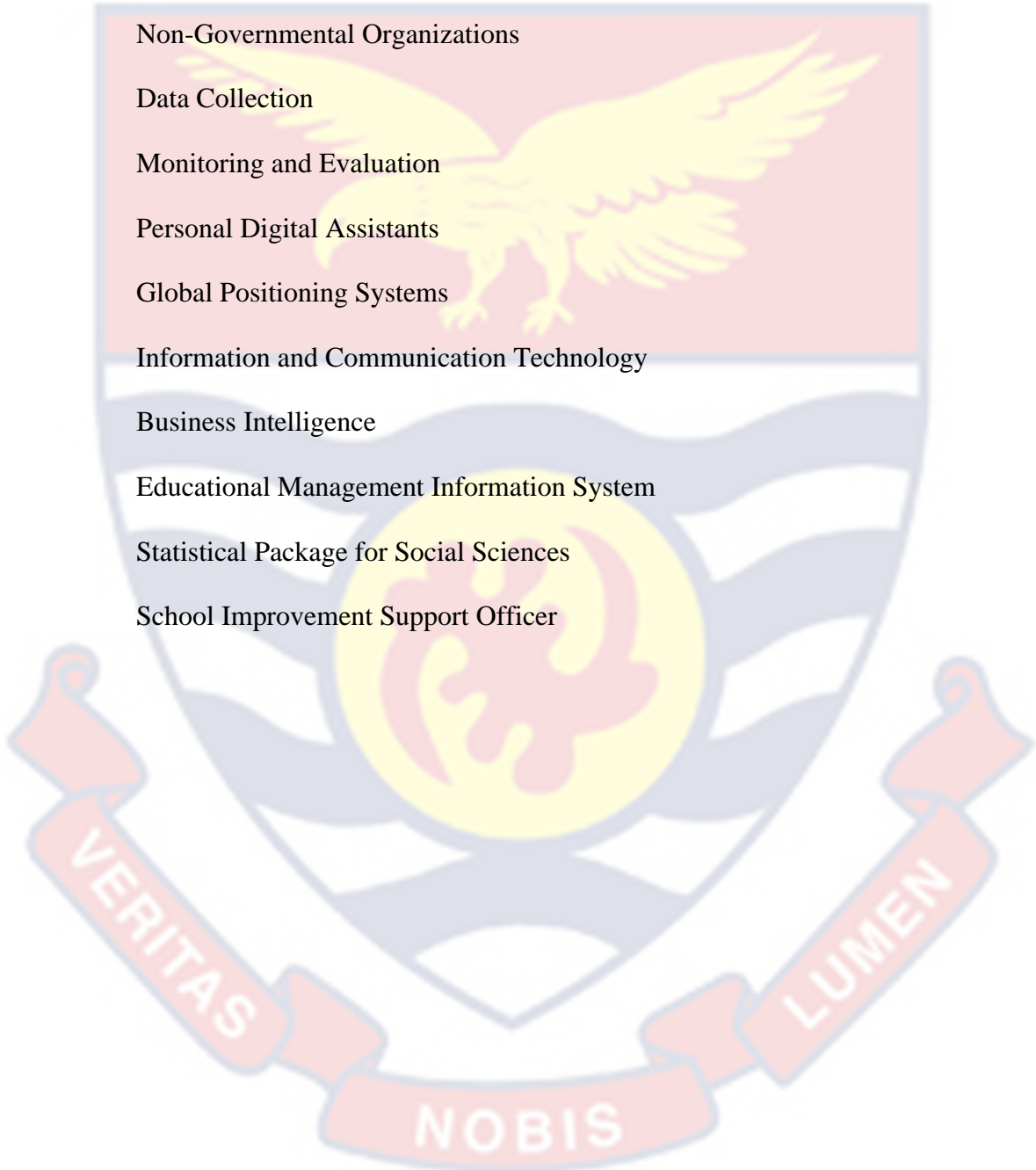
Global Positioning Systems

Information and Communication Technology

Business Intelligence

Educational Management Information System

Statistical Package for Social Sciences

School Improvement Support Officer

ACKNOWLEDGEMENTS

I am immensely grateful to my Supervisor Kwame Poku-Antwi whose guidance, expertise, and encouragement have been invaluable. His insightful feedback and unwavering support have shaped the direction of this research and inspired me to strive for excellence.

My sincere appreciation also goes to Dr Thomas Nketia Wobil for sharing expert knowledge and direction on the design of a robust M&E system. Sir, I am most grateful.
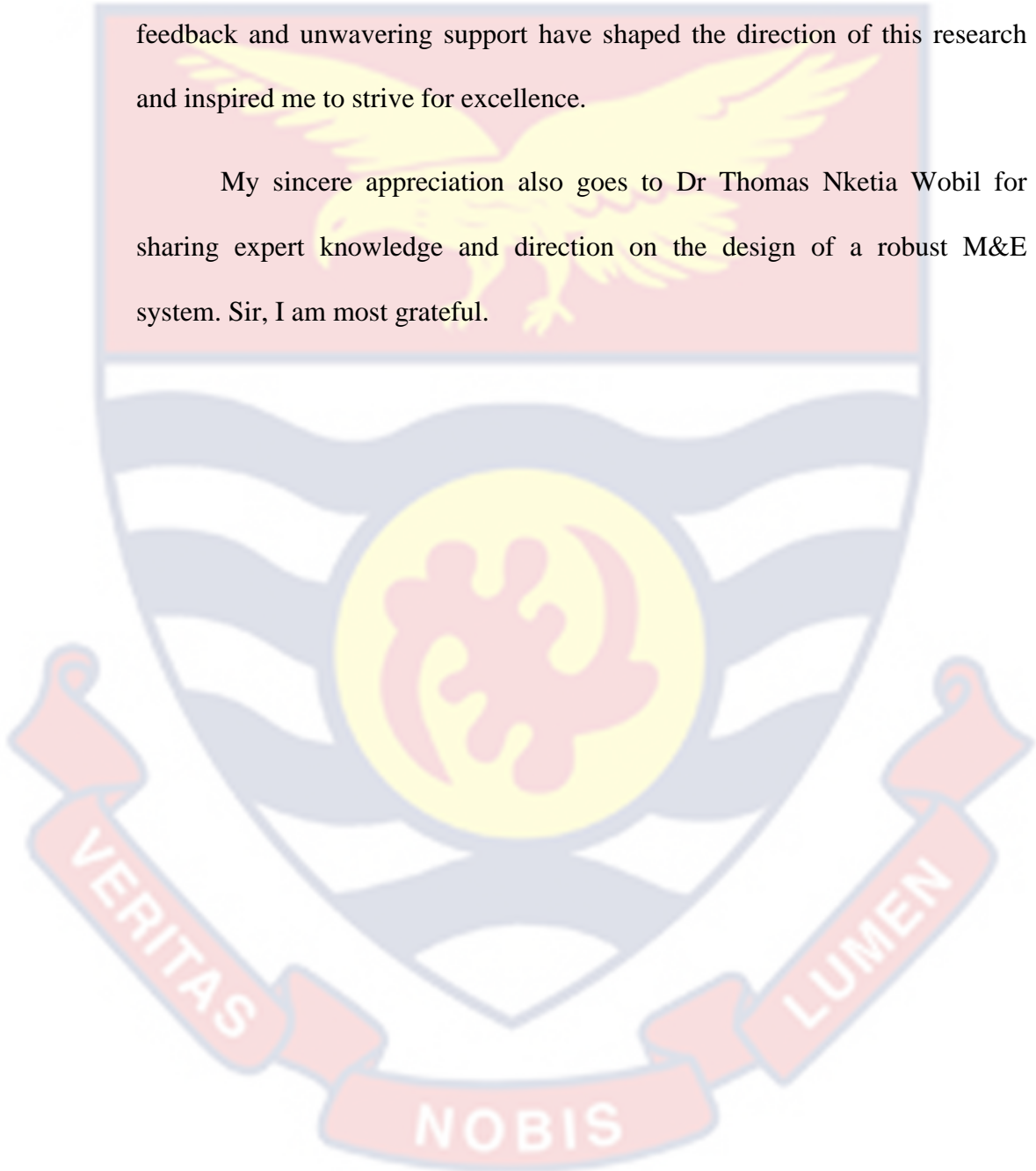
DEDICATION

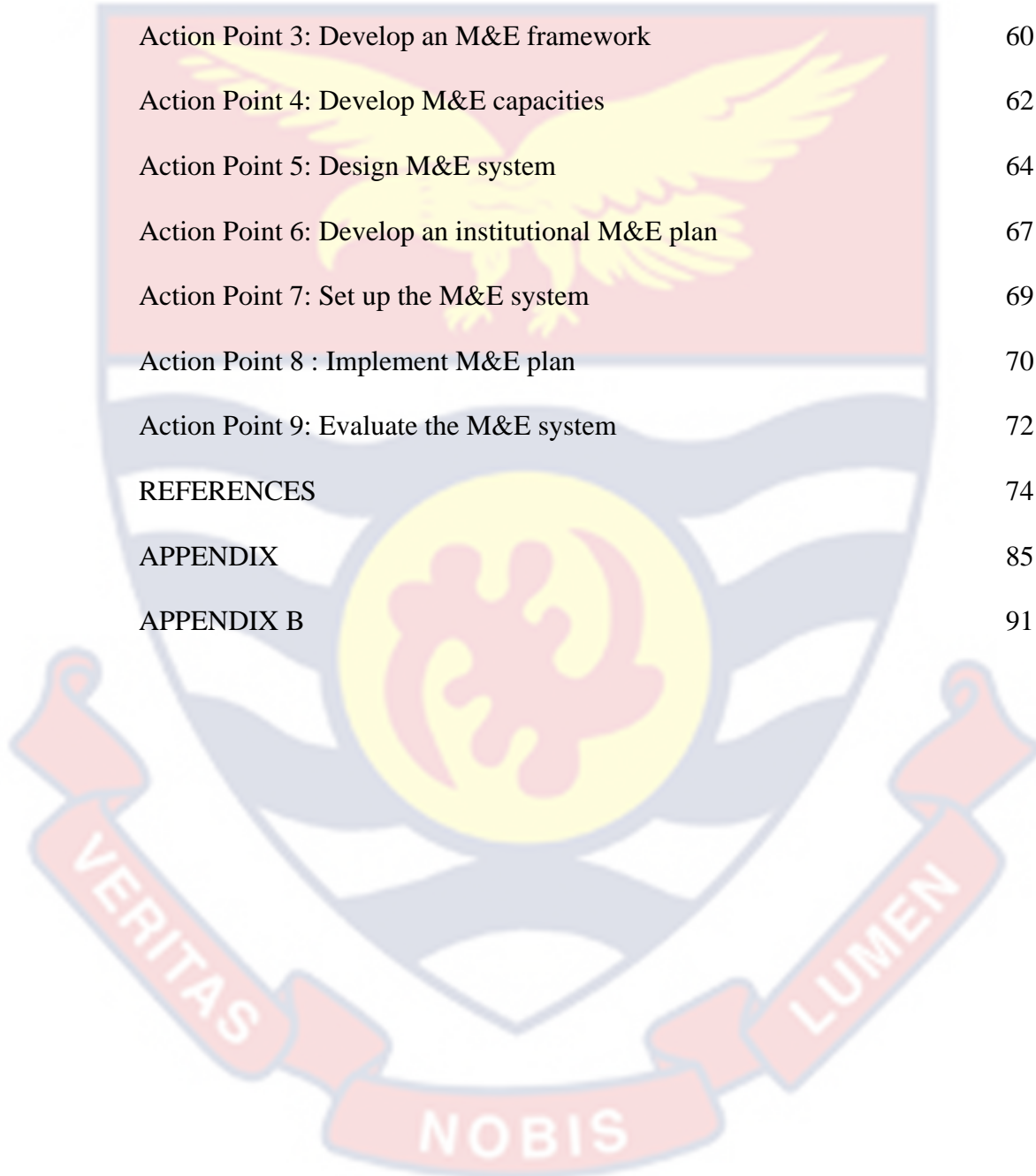I dedicate this work to Pastor Kwabena Okyere and my mother Linda Bonuedi.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

MDC	Mobile Data Collection
MDCT	Mobile Data Collection Technology
MOE	Ministry of Education
ESP	Education Strategic Plan
TOR	Terms of Reference
GES	Ghana Education Service
CAPI	Computer-Assisted Personal Interviews
NGOs	Non-Governmental Organizations
DC	Data Collection
M&E	Monitoring and Evaluation
PDAs	Personal Digital Assistants
GPS	Global Positioning Systems
ICT	Information and Communication Technology
BI	Business Intelligence
EMIS	Educational Management Information System
SPSS	Statistical Package for Social Sciences
SISO	School Improvement Support Officer
NAMA	Nsawam/Adoagyiri Municipal Assembly
COHBS	Conference of Heads of Basic Schools

CHAPTER ONE

INTRODUCTION

In today's digital age, the use of mobile data collection has ushered in a transformative era for education. The convergence of technology and education has created unprecedented opportunities to collect, analyze and mine data to improve the teaching and learning experience. Mobile data collection in particular has become a powerful tool, revolutionizing the way educators, administrators, and policymakers collect and use educational information. The integration of mobile devices, such as smartphones and tablets, into educational practices has fundamentally changed the way data is collected and used in educational settings. This paradigm shift has opened new avenues for educational research, monitoring, evaluation, and decision-making. Whether tracking student learning outcomes, assessing the effectiveness of teaching methods, or improving the overall education ecosystem, mobile data collection has become an indispensable tool for education stakeholders. The motive behind this research is to assess how data collection technology exists in the Ghana Education Service.

Background of the Study

According to (Bazilio, 2020), one of the key ways in which the state is still connected to the economy is through education. He affirmed that education plays a pivotal role in the development of both the individual and the nation as a whole. The extent to which future economic and poverty reduction objectives may be carried out in terms of preparing people for future

inclusion in the labour market depends critically on the judgments and policy choices made in the area of education. Using current information technology items, such as phones, smartphones, and tablets (hardware), as well as a variety of potential software applications (software), for data collection is known as mobile data collection (MDC). Data is entered into a device that can export information directly into a centralized database rather than writing information down on paper with a pen and then manually entering it into a database for analysis (Lavrakas et al., 2017).

Baker et al, (1991) found that these techniques are sometimes known as "computer-assisted personal interviews" (CAPI). MDC is best understood as merely another tool in the toolbox of a data collector at its heart. When used effectively and with the right kinds of questions, it is a potent technique, but it does not necessarily represent a fundamental shift in how conventional data is gathered. They further explained that the field of MDC has combined existing technology with traditional procedures, frequently resulting in an enhanced procedure. Although it necessitates some novel planning and implementation skills that may seem overwhelming at first, it shouldn't be viewed as something wholly foreign. MDC merely makes it possible for program staff to investigate research questions more quickly. From the data collector's point of view, it is simply a variation of one of the many tools used in the research project or in the monitoring system.

MDC is not a magic bullet for undoing the damage caused by subpar M&E design, poorly chosen indicators, or improper analysis. The limitations

imposed on data analysis by factors like sampling frame, sample size, the absence of a baseline or control group, response/non-response bias, etc. will still exist. Similar to every instrument, its effectiveness depends on who is using it. Adequate, thorough, fair, and ongoing supervision and evaluation are necessary for the effective running of educational programs. Additional steps are needed every time an educational program is implemented so that implementation success may be easily evaluated. (Bernard, 1980)

Statement of the Problem

According to (Safaryan, 2020) monitoring and evaluation measures in the education sector are key to maintaining established standards and detecting issues that can negatively impact the quality of teaching and learning in schools. Despite the introduction of Mobile Data Collection (MDC) technology in the Education sector by several agencies and Non-Governmental Organizations (NGOs), the current situation is done largely using the Paper Data Collection method. This old-fashioned method of data collection has had a great negative impact on education. This is because paper-based mobile data collection does not generate timely and accurate results.

This system of Data Collection (DC) is slow and very ineffective since a huge number of papers need to be printed, distributed, and completed using pens. Once DC is done, all completed forms are gathered and sent back to wherever they were sent from. This has been the practice of collecting data in the Education sector. In order to address the issue, how can the data collection system be improved? In other words, the study seeks to assess the utilization

3

of the MDC technology in the Education sector; a case study in Ghana Education Service.

Objectives of the Study

To achieve the goal of the study, the following objectives are contrived;

1. Ascertain the Mobile Data Collection system available for M&E within the Ghana Education Service.

2. Assess the technical, structural, and financial resource capacity within Ghana Education Service for efficient and effective mobile data collection in M&E systems.

3. Assess the plan of action to strengthen the existing mobile data collection technology in M&E in the Education Sector.

Research Questions

In order to accomplish the study's goals, the following inquiries need to be addressed:

1. Which mobile data collection technology is available and used for M&E within Ghana Education Service?

2. What technical, structural, and financial resource capacity is within the Ghana Education Service for an efficient and effective mobile data collection system?

3. What plan of action to strengthen the existing mobile data collection technology in M&E exists within the Ghana Education Service?

4

Significance of the Study

After the successful completion of the research work, the result would be relevant in diverse ways. For instance, it will help to expand the existing knowledge on the relevance of Mobile Data Collection technology in the Education Sector. It would also offer some recommendations for future researchers and serve as reference material for future researchers. To the industry players, it would offer relevant information to M&E specialists, NGOs, and other agencies. Again, it would help expand broad stakeholder engagements on the effective use of MDC in Monitoring and Evaluation in the Education sector. Equally, the findings would help to address the availability of Mobile Data Collection systems for M&E within the Ghana Education Service. Finally, the study would fill the existing research gap in the literature and upcoming researchers who are interested in the same or similar topic would make use of the document as secondary data.

Scope of the Study

The objective of the research is to assess the utilization of Mobile Data Collection technology in Monitoring and Evaluation in the Education Sector, specifically; Ghana Education Service. The Ghana Education Service aims to facilitate effective teaching and learning and efficient management through creating conducive environments in all educational institutions and management positions, to attain their goals. Also, GES is responsible for the implementation of approved national pre-tertiary educational policies and programs to ensure that all Ghanaian children of school-going age irrespective

5

of tribe, gender, disability, religious and political affiliations are provided with inclusive and equitable quality formal education. Therefore, the study will concentrate on only Ghana Education Service.

Limitations of the Study

The use of mobile data collection has become a highly effective means of gathering data in the field of education. Given the widespread availability of mobile devices, researchers have been able to leverage these tools to collect data with greater efficiency and in real-world settings. However, it is critical to acknowledge the potential drawbacks of this approach, as it can have a substantial impact on the accuracy, consistency, and applicability of research outcomes. One of the major limitations of mobile data collection in educational research is the potential for sampling bias. This is because the information gathered through mobile phones is dependent on the individuals who regularly use and own these devices. This access bias could lead to incomplete results, inadvertently excluding individuals from disadvantaged socioeconomic backgrounds or areas with limited technological infrastructure, therefore reflecting an incomplete educational landscape.

Although mobile data collection provides convenience, it also presents technical challenges that must be considered. The success of this method is reliant upon the capabilities of the equipment, the dependability of the Internet connection, and the compatibility of the data collection equipment with other devices. If technical malfunctions, equipment problems, or connectivity issues arise, the accuracy and consistency of the collected data may be compromised.

6

Despite these limitations, the credibility of the research work still holds and is accepted.

Organization of the Study

The research work consists of five (5) major chapters; Starting with Chapter One which contains the background of the study, the problem statement, and objectives which are categorized into two; main objectives and specific objectives. The rest are the research questions, the scope of the study, and an overview of the limitations and organization of the study. Chapter two contains the literature review which deals with major thematic areas such as the theoretical review, the empirical review, and the conceptual framework. Chapter three looks at the research methodology in detail; research design, data sources, the target population, sampling techniques, data collection procedures, and techniques of data analysis. Chapter four also focuses on data analysis and discussions of the major findings. Finally, chapter five examines the final aspect of the work. It contains a summary of the findings, conclusion, and recommendations deemed necessary by the researcher.

7

CHAPTER TWO

LITERATURE REVIEW

This chapter presented a thorough literature review relevant to the study objectives. The review comprised of three (3) sections: theoretical, conceptual and empirical reviews. The theoretical section presented the foundational theories that underpinned the work. The conceptual section reviewed literature related to the assessment of the utilization of Mobile Data Collection Technology in Education. The empirical section explored literature pertaining to each of the study objectives. Finally, the conceptual framework visually depicted the study objectives, along with the theoretical and empirical reviews.

Theoretical Review

The study adopted Data collection and Mobile Data Collection.

Data Collection

The process of gathering data is crucial in acquiring high-quality and valuable information that enables governments, institutions, businesses, and academic bodies to scrutinize it and consequently answer research inquiries, enhance decision-making, improve productivity, establish essential facts and resolve problems. Due to the growing significance of data, there is an escalated concern in finding practical methods to approach impact assessment and data collection. According to (Onoka, 2017), E-commerce, online service providers, investment markets, and companies are amassing information and feedback about their services. Scrutinizing the data helps them learn and adapt their services to meet customer needs.

8

Data Collection Methods

According to (Bazeley, 2003) many social scientists use the words "qualitative" and "quantitative" to divide the world of approaches to research. Unfortunately, discussions of this distinction do not derive from uniform definitions of these terms nor from careful analyses of the meaning of this distinction. A dichotomous, unidimensional distinction between quantitative and qualitative approaches is not particularly useful, because it ultimately refers only to whether the data were coded into numbers or into text (Lieberson, 1992).

(Axinn et al., 2003) discussed five specific types of data collection methods; surveys, semi-structured/unstructured interviews, focus groups, observations and historical/archival research. Each of the methods has specific advantages making it particularly well suited to some types of research aims. Surveys are particularly useful when a high level of standardization is desirable. This may be true when the research aim involves creation of standardized facts for a large population, such as a summary statistic (Groves et al., 2004).

However, the use of trained interviewers and mail or web questionnaires in survey administration reduces the need for the survey designer or principal investigator to have direct contact with the people being studied (Groves et al., 2004).

Mobile Data Collection

Mobile data collection (MDC), according to the use of existing computing products such as phones, smartphones, and tablets (hardware) and

9

some programs (software) may be present, to collect data. Instead of jotting down information on printed paper with a pen and then manually entering it into a database for interpretation, the data is entered into a device that can then be exported directly to a centralized database (which can be done over the Internet or an intranet. These methods are sometimes referred to as Computer Aided Personal Interviews (CAPI). At its most basic, it is best to think of MDC as just another method in the data collection toolkit. Devkota et al. (2021) indicated that Mobile Data Collection technology improved the quality and timeliness of data collection in a health facility in Nepal.

Similarly, the study by Akinbobola and Adeyemo (2021) also showed that Mobile Data Collection technology improved the accuracy and completeness of data in social science research projects in Nigeria.

Mobile data collection tools offer exciting and innovative opportunities to enhance the quality of research and M&E projects. From project managers to researchers, it enables cheaper and faster access to a better quality of data that can be analyzed than traditional paper-based methods and enables increased responsiveness to challenges. needs arise at the site. In this sense, it is a significant toolkit that goes beyond research, because when effectively integrated into the M&E framework, these tools can greatly assist with the needs and aspirations of different programs. This is a toolkit that is increasingly being used by a variety of actors around the globe, with positive results.

Despite its innovative nature and advanced technological tools, it is important to recognize the fact that all the basic principles of MDC are the same as those of data collection using any other tool. Successful use of the MDC toolkit will always depend on properly formulating and operating the research questions, choosing the right data types to answer them, and analyzing the results scientifically. MDC should be seen as something that empowers researchers rather than replacing them. As tools, their effectiveness depends on the effectiveness of the researcher using them, and their true benefits can only be achieved when they are used within the framework of the right projects. Understanding the data types for which MDC is best suited and making informed decisions about which tools in MDC to use is critical to getting the most out of those tools (Raghavendra et al., 2004).

Boukerche et al., 2008 also affirmed that like any toolkit, MDC has both strengths and limitations, as well as cost and benefit dynamics for any given situation. This handbook aims to equip readers with the knowledge they need to begin assessing the benefits and costs that MDC tools can bring to their project, organization or program, if any. It also provides advice on how to design and build the capacity needed to use them for the successful implementation of these tools. There are many decisions to be made and it may seem like too many choices at first, but hopefully, this guide can shed some light on some aspects of MDC and encourage the use of data collection mobility in projects and organizations to move forward.

11

The Beginning – The Roman Census Approach

To comprehend the primary impact of technology in general and mobile technology in particular on data gathering, it is necessary to delve into the past. Roughly 2500 years ago, the Romans determined that they needed to levy taxes on every citizen in their empire. To achieve this objective, they recognized that they must first conduct a census to count the citizens and gather their information. The Roman Empire spanned a vast area, from Britain in the west to Persia in the east, with people from various regions, including Germany, Spain, Persia, Israel, and North Africa. The Romans soon realized that it would be impractical to require all and sundry to travel to Rome to be recorded. To address this challenge, the Romans dispatched officials from Rome to different parts of the empire who gathered specific census data from the various regions and returned them to Rome (Hin et al., 2016)

"And everyone went to their own town to register. So, Joseph also went up from the town of Nazareth in Galilee to Judea, to Bethlehem the town of David, because he belonged to the house and line of David. He went there to register with Mary, who was pledged to be married to him and was expecting a child." (Bible, Luke 2:3-5)

As stated, the process of gathering data was intricate and challenging, requiring significant resources and a considerable amount of time to collect census information in Rome (Claytor et al., 2015). Nowadays, there have been remarkable advancements, all thanks to mobile technology, which enables us to collect millions of data entries, and data bytes, within a vast area in mere seconds (Davidson et al., 2019).

12

Benefits of Mobile Data Collection

Numerous organizations are looking into how mobile phones might be used effectively as part of massive data collection efforts in many sectors, including education, as a result of the explosive growth in the availability of mobile phones in societies around the world - even in some of the poorest, most remote communities (Srivastava, 2005). Of course, using small, mobile electronic computer devices to assist in data collection is nothing new. Laptop computers and personal digital assistants (PDAs) have been used in surveys of potential voters, customer interviews for various goods and services, and census data collection for more than 20 years. However, these initiatives frequently encountered obstacles such as financial limitations, the relative novelty of such devices among certain population segments, the requirement for device-specific user training, and challenges in data exchange between these devices and other parts of a larger data collection system (Chen, 2011).

The mobile phone, for the majority of the globe, satisfies these requirements rather well if, as has been argued, the greatest technology is frequently the one you already have, know how to use, can maintain, and can afford. Mobile phone penetration rates reached 96% worldwide as of the end of 2013 (128% in developed and 89% in developing nations). The International Telecommunications Union states that "now there are almost as many nearly as many almost as many cellular subscriptions for mobile devices as there are people on the planet. It is not unexpected that mobile phones have been used in a variety of ways to support data-gathering activities all around

13

the world given their ubiquity, growing features, and declining related acquisition and running costs. While many people might think that such initiatives call for the usage of high-end (and pricey) smartphones, phones of all varieties have been successfully used for various purposes in various circumstances.

Mobile data-collecting tools offer many advantages over conventional approaches, even though they are not necessarily revolutionary. The sections following go into more detail about some of the primary advantages.

Speed

Data gathered for analysis can be ready in a substantially shorter period using MDC techniques. Access to data can even become instantaneous as it is instantly entered electronically and can be exported into a statistics program or a system for information management (Nayak et al., 2019). Internet technology readily allows access to data both worldwide and in real-time. The process of gathering data can be significantly sped up by using a mobile phone. The shorter time between local data collection and delivery might save weeks or even months in the total data-gathering process where network availability allows for the near-instantaneous transfer of data to a central coordinating group. Moreover, a kind of early warning system can be set up, enabling survey organizers to quickly spot possible issues with data gathering efforts and (perhaps) address them in virtually real-time Chen & Casciati, 2014).

14

Utilizing mobile technology for gathering data is an effective instrument that considerably reduced the duration of research. The proliferation of mobile internet usage has made it feasible to disseminate survey research to numerous participants located anywhere in the world in a brief period. Additionally, retrieving survey results is swift, enabling researchers to gather, scrutinize, and take prompt action or make decisions almost instantly. Moreover, the mobile tool can be reused for subsequent surveys in a short period (Wagner et al, 2014).

Depending on the chosen program, data can also be presented automatically in a visual format to track the most important metrics without requiring the statistician to analyze it manually (Kim et al., 2013). The speed of conducting real interviews can be slowed down, especially for longer, more complex surveys, in addition to faster data turnaround owing to the elimination of separate data input (Manfreda et al, 2012).

Interviewers do not need to focus on skipping or wasting time checking if each question has been asked and all required fields are filled in, as they will automatically be given questions appropriate questions to ask. The quicker turnaround time is essential from a programmatic standpoint because it enables greater responsiveness to difficulties that develop on the ground. This is particularly crucial while data gathering is ongoing since it allows for the quick identification and correction of patterns that are either increasing or decreasing (Walther et al, 2011).

15

Cost

Although there are some upfront costs associated with using MDC tools, which are discussed in more detail in the following sections, this can also result in significant cost savings, including eliminating data entry. Traditional exploration processes often require "dual data entry", where two different employees input the same data and the supervisor records the difference between the two employees. Reducing this superfluous process can often result in significant cost savings. The savings from this operation increase with survey size because manual entry requires a specific time for each scrutiny. Printing costs can also be reduced, which can increase as survey and interview time increases (e.g., take a questionnaire of 30 pages for a sample of 1,000 interviewees) (Goodman et al., 2013).

The obligation to reprint documents no longer exists as any errors in the research can be corrected by computer and updated to the data collection tool used. Flexible and customizable mobile tools have the potential to help keep costs down. Consider researching an area where there are five different languages present.are spoken. Using traditional pen and paper, when printing surveys, an estimate of language prevalence (if statistics are documented) should be considered. From a program perspective, spending money on a shared platform that can be applied to multiple projects can help spread costs and offload a particular research or data collection cycle.

Potential Cost Saving

Conducting surveys using a mobile device can save money. When more people participate in a survey, there is the likelihood of greater savings. By using mobile smartphones for survey research, the need to print thousands of pages of questionnaires can be eliminated. This not only saves money but also helps the environment (Nayak et al. 2019). A World Bank study found that 88.9% of interviewers preferred to use mobile data collection tools. According to (Schuster C. and Brito CP., 2010) MDC is much more cost-effective and showed noticeable improvements in quality control as well as improvements timeliness of survey execution as well as improving Quality and Real-time Data Collection.

In addition, if the survey is large and will be distributed to respondents in different regions and in different languages, there is no need to print additional copies for each language. Instead, participants can access the survey in their preferred language on a mobile smartphone.

Data Quality

Devkota et al (2021) indicated that Mobile Data Collection technology improved the quality and timeliness of data. MDC tools have improved the quality of the data in two different ways. First off, the creation of surveys enables extensive customization and the addition of a variety of quality control instruments. It is feasible to use filter logic to remove any potential ambiguity in the questionnaire's instructions. Second, there exists no risk of errors in the data entry in this step because there is no need to import the data import

17

independently from paper into the computer. The data entered during the interview can also be verified using MDC technology. For example, queries that require numerical responses may be made to accept only numeric responses, which can also fall within a certain threshold (e.g., 1 to 99 for age) to reduce the risk of errors when entering. Cross-referencing responses to the age and date of birth questions verifies that they match and forces the interviewer to explain any discrepancies. Incomplete forms may have encryption that prevents them from being submitted.

Some MDC tools automatically collect metadata, such as timestamps, being part of the pre-programmed questions in the survey. They allow survey managers to track interview start and end times to ensure they are consistent with expected interview behaviour, keeping interviewers accountable (Porter et al., 2021).

Combining data collection and survey research entry is possible, eliminating the need for transcription from paper, and preventing data mis-entry from affecting research results. In addition, entered data can be checked for human error as participants enter by setting specific rules, such as requiring numerical answers to certain questions (Barchard & Pace, 2011).

Researchers can also supervise the survey submission process and prohibit participants from submitting if they skip questions, ensuring that the survey is completed accurately. On the other hand, using the traditional paper and pen method can lead to loss of data and incomplete records, errors, and

18

inconsistent answers, as evidenced by (Njuguna, 2014, p. 107). However, data collected using smartphones are less likely to have these issues.

Customization and Flexibility

The choice of technique or approach utilized by the survey creator, such as a Mobile App or Website, determines the ability to personalize survey questions. This includes but is not restricted to, varying the number or category of questions based on factors like age, gender, and location of the participant (Schobel et al., 2016). Additionally, the creator can incorporate intricate logic into the survey, such as displaying different questions or altering the sequence of questions based on previous participant responses. These characteristics remain hidden from participants and do not disrupt the survey flow, setting them apart from conventional paper and pen surveys.

Some Limitations of Mobile Data Collection

Mobile data collection technology poses to have advantages as well as disadvantages (Nayak et al., 2019). The advantages are vast and the tools are adaptable, as this section demonstrates. They have a wide range of applications. Even though issues like poor Internet connectivity or electricity grids can be obstacles, most of them can be handled with careful planning. It is important to keep in mind that MDC does not represent a magic fix for improper survey design, nor a magical tool that makes all information-gathering activities more effective. One key factor among the main drawbacks of mobile technologies is the difficulty of typing responses because many keyboards lack 10-finger functionality and because systems do not allow for

19

the easy taking of side notes that may be necessary during open-ended or qualitative interviews (Wilcox et al., 2012).

Due to the necessity to collect vast amounts of open text in qualitative approaches, MDC technologies are currently limited in their applicability. Making brief notes on paper and with a pen still tends to be more successful and efficient in such endeavours. Digital forms, however, might be used to enhance categorical data by gathering details like GPS coordinates (Charlton et al., 2011).

MDC can be Expensive

Electronic methods for collecting data have been developed to streamline the process of both data collection and data entry. Personal digital assistants (PDAs) are increasingly being used in place of traditional paper and pencil methods for data collection. However, PDAs also come with their own set of challenges, such as the need to download data to expensive laptops in the field and the risk of data corruption or loss if the device is damaged, misplaced, or stolen. While the initial cost of the device may seem daunting, the device can be used for multiple rounds of data collection in projects (Tomlinson et al., 2009). Using MDC requires some new hardware, abilities, and competencies. However, the cost of technology can be expensive (Nayak et al., 2019).

Difficulty in Learning the Technology by Enumerators

Some enumerators may be comfortable with the old way if collecting data and introducing them to a new technology may pose a problem to them.

20

(Jagger et al., 2012). They affirmed that Mobile Data Collection process might be delayed due to this hinderance.

Conceptual Review

The conceptual review focused on Monitoring and Evaluation.

The Concept of Monitoring and Evaluation

Monitoring is described by Bartle (2007) as the routine scrutiny and documentation of events occurring inside an intervention or program. It is a technique of routinely gathering data on every facet of the project. Project execution, coverage, and usage data are primarily collected and analyzed as part of ongoing monitoring. The definition of monitoring in this context specifically states that it is the "constant assessment of project execution in accordance with established timelines and the usage of input from project beneficiaries, facilities, products and offerings". When reporting on the operations of the components of the educational system, monitoring is the act of gathering data and frequently combining key indicators to count or calculate inputs, outputs, and processes (Mishra, 2005). Monitoring is an evaluation technique that collects specific data for system improvement (Noh, 2006). Monitoring is an ongoing process that uses systematic data collection on specified parameters to provide management and key development project stakeholders with an indication of progress and achievement in relation to expected results and progress in the use of allocated capital.

According to Marriott and Goyder (2009), evaluation is a planned, carried out, and performance-oriented systematic and objective review of a

21

continuing or ended program. Evaluative research is a branch of social science that systematically gathers data on the conception, execution, and effects of programs on the populations they are intended to serve. By assessing the program's performance in reaching its initially indicated transitional and ultimate goals, evaluation can reveal changes in the behaviours and conditions of targeted groups and individuals.

Empirical Review

The Empirical review focused on Mobile Data Collection using smartphones

Mobile Data Collection Using Smartphones

Mobile phones are a type of technology that can be utilized to conduct survey research. This can be accomplished via the Internet, as it allows for online surveys. The introduction of GPS features in smartphones has revolutionized market research, as it allows for the tracking and reporting of the geographic location of the device. As a result, mobile technologies like geo-fencing have emerged, which leverage location data to conduct targeted marketing research and analyze consumer patterns. In the future, geo-location technology may enable researchers to conduct more comprehensive in-situ exploration by tracking comprehensive information for consumers and predicting product and service demand. Additionally, smartphones equipped with video and audio recording capabilities can be incredibly useful for researchers seeking to collect data (Kimball, 2019).

However, a significant limitation is that many people remain unwilling or unable to administer these features. Nevertheless, the utilization of text

22

messages has become increasingly popular, and push notifications on smartphones have proven to be a valuable tool for conducting surveys and tracking participant locations (Kaufmann & Peli, 2020). Smartphone mobile data collection is a technique for assessing and monitoring people's thoughts, feelings, behaviors or physiological processes in daily life using smartphones. It is a subset of the emergent, transient ecological, and empirical sampling methods groups (Mehl and Conner, 2012; Miller, 2012; Trull and Ebner-Priemer, 2013; Harari et al., 2016). This procedure's main objective aims to directly gather active data (such as subjective idiosyncratic reports) and/or passive data (such as data from smartphone sensors) from individuals as they go about their daily lives.

Smartphones are widely available and are equipped with the computing and sensor capabilities needed to collect data about the owner's daily activities, making this data collection and evaluation easier. convenient. Researchers in the fields of social science, psychology (e.g. Miller, 2012; Harari et al., 2016) and neuroscience (e.g. Schlee et al., 2016; Ladouce et al., 2017) uses smartphones to collect data on personality, processes and motivations (Germany and Mehl, 2017; Beierle et al., 2018a; Stieger et al., 2018; Zimmermann et al., 2018), daily cognitive behavior (Aschwanden et al., 2018), socially supportive behavior (Scholz et al. et al., 2018). transient thoughts (Demiray et al., 2017), couple interactions (Horn et al., 2018), physical activity (Gruenenfelder-Steiger et al., 2017) and mood and emotions (Erbas et al., 2018).

23

Smartphone data gathering offers a glimpse into people's regular impressions, encounters, and interactions with their surroundings. Mobile device analysis of people's daily lives is not a recent research technique. Yet given that cell phones are now so widely used, they are inexpensive, they include sensor technology, and they are prepared for data collecting through apps. We are currently in an important period for smart mobile data collecting (Miller, 2012; Cartwright, 2016; Harari et al., 2016; Beierle et al., 2018a). Despite significant advancements, we believe that this procedure still has room for improvement based on our experiences and conversations with specialists in the industry.

Smart Mobile Data Collection

Mobile data collection using cell phones offers numerous advantages and is becoming increasingly popular. Researchers can collate and collect this data with the aid of smartphone by setting random, continuous, or event-based alerts that prompt participants to answer questions or report events throughout the day. An individual's behavior and experiences are captured by extensive repeated measurements of a single participant. On the other hand, inter-person information reveals individual variation.

Contrary to between-person information, gathering within-person data enables the study of the systems and processes that underpin behaviour (Hamaker, 2012). For instance, a study by Stawski et al. (2013) demonstrated that processing speed is crucial for comprehending between-person variations in working memory but attention switching is more crucial for understanding

changes within a person. Consequently, it may be claimed that consistent observations of people are necessary to understand the dynamic character of psychological processes. Smartphones are the best devices for this type of data collection.

Real-world data measurements are also rich in contextual information because mobile data collection combines subjective assessments including physical activities, body movements, social engagements, bodily processes, and biological indicators (also known as passive data) with self-reports or observer-report (Ebner-Priemer et al., 2013). To gather the objective patterns of participants' real proximity to and contact with others, it is conceivable to simultaneously record acoustic sound clips of discussion and collect self-reports (such as people's emotions of social inclusion). Last but not least, smartphones are effective measurement tools that are widely used. This makes it possible to execute machine learning methods inside the devices and to analyze data in real-time, enabling extensive, customized, dynamic, and intensive real-life studies (Bleidorn and Hopwood, 2018).

Because the majority of participants already own smartphones, all they need to install to take part in research is an app (Miller, 2012). This enables investigators to carry out investigations using big samples (Dufau et al., 2011). Harari et al., (2016) identified the contextual data that may be gathered using smartphone sensor data (i.e., passive data) as a fourth difficult area since researchers need to take into account the various types, intervals, and amounts of sensor data (e.g., GPS data, app use, and accelerometer data). Researchers

25

must look at more than the data itself, while simultaneously collecting passive data over several days; they must also be able to decipher what the measurements represent and translate the data into psychologically meaningful traits, such as sociability or movement patterns.

While this activity is essential to research, it often requires new technological capabilities from researchers as well as methods that would, in an ideal world, automatically aggregate data based on receptor sensors. from smartphone. For example, it is advantageous to automatically identify the words spoken by the target person when collecting audio files containing the conversation (Mehl et al., 2001), for contextual information recognition (Lu). et al., 2012) or interpret GPS data on cellular patterns (Ryder et al., 2009). Preliminary solutions already exist to meet such requirements (Barry et al., 2006; White et al., 2011), but much more research and development is needed before data can be generated. Automated, preprocessed and reliable smartphone sensors. Combine with other types of data collection.

Summary

Conducting extensive field surveys is a regular occurrence in the realm of health research. In countries with limited resources and administrative obstacles to gathering health-related information, surveys are often the sole means of obtaining dependable data. Traditional paper-based data collection methods have been in use for many years, but they are prone to errors, expensive in terms of storage, and require costly double data entry. To streamline the data collection and entry process, electronic methods have been

26

developed. Personal digital assistants (PDAs) are increasingly being used in place of pen and paper, although they present their own challenges, such as the need to download data (which can be expensive in places) remotely and the risk of loss or loss of data. Data damage due to damage or theft of the device.

Wireless technology and cell phones offer solutions to some of these problems and can be adapted for use in field research. In low- and middle-income countries, fixed Internet access is often insufficient, but wireless networks provide telecommunications in areas with limited fixed-line access. Smartphones provide fresh and distinctive opportunities for studying people and processes in the real world and in real time. With the use of a typical smartphone, this method gives researchers the chance to gather real-time reports of participants in their natural environment, as well as within their own dynamics and life circumstances. The strategy, however, also presents several difficulties that open up intriguing possibilities for future advancements. Although smartphone-based mobile data collecting is already quite intelligent, we see the potential for it to become even more intelligent in the future.

Smartphones offer unique new opportunities to study people and processes in the real world and in real-time. Using a common smartphone, this method gives researchers the ability to collect real-time reports of participants in their natural environment, as well as motivations and living circumstances. theirs. However, this strategy also presents a number of challenges that open up exciting possibilities for future growth. While mobile data collection on smartphones is already pretty smart, we think it could get even smarter in the

future. Smartphones and other mobile devices have become an integral part of the daily lives of millions of people, making them important tools for data collection and survey research. The use of mobile devices has revolutionized the data collection process, providing new opportunities and methods for researchers. Efficient and effective data collection is an essential part of any research, and mobile technology has changed the way it is done. The ability to collect both qualitative and quantitative data using mobile technology has become an important aspect of modern research, whether in academia or business. Stakeholders and investors expect rapid results and conclusions that can be achieved through the use of mobile technology.

Mobile technology offers an innovative approach to data collection, with many advantages over traditional paper surveys. Compared to traditional methods, mobile technology enables faster data transmission, reducing errors and inconsistencies, and reducing costs. Traditional primary data and information collection methods have been replaced by more advanced techniques using mobile technology and the Internet. This approach has been widely adopted for research purposes worldwide.

**Ministry of Education (MoE)**

The Ministry of Education in Ghana is responsible for policies on education, apprenticeships, and skills acquisition. Its goal is to provide equal opportunity for education regardless of background or family circumstances.

In 1957, the Ministry of Education (MoE) was created with the goal of formulating and coordinating education policies, establishing standards, and

28

overseeing their implementation. The MoE strives to make quality education available to all Ghanaians, thereby supporting human capital and national development.

The Ministry of Education (MoE) in Ghana is dedicated to equipping all citizens with the necessary skills to excel in their careers. To achieve this, the MoE prioritizes a curriculum that emphasizes problem-solving and creativity and offers a range of academic, technical, and vocational programs that build critical skills.

29
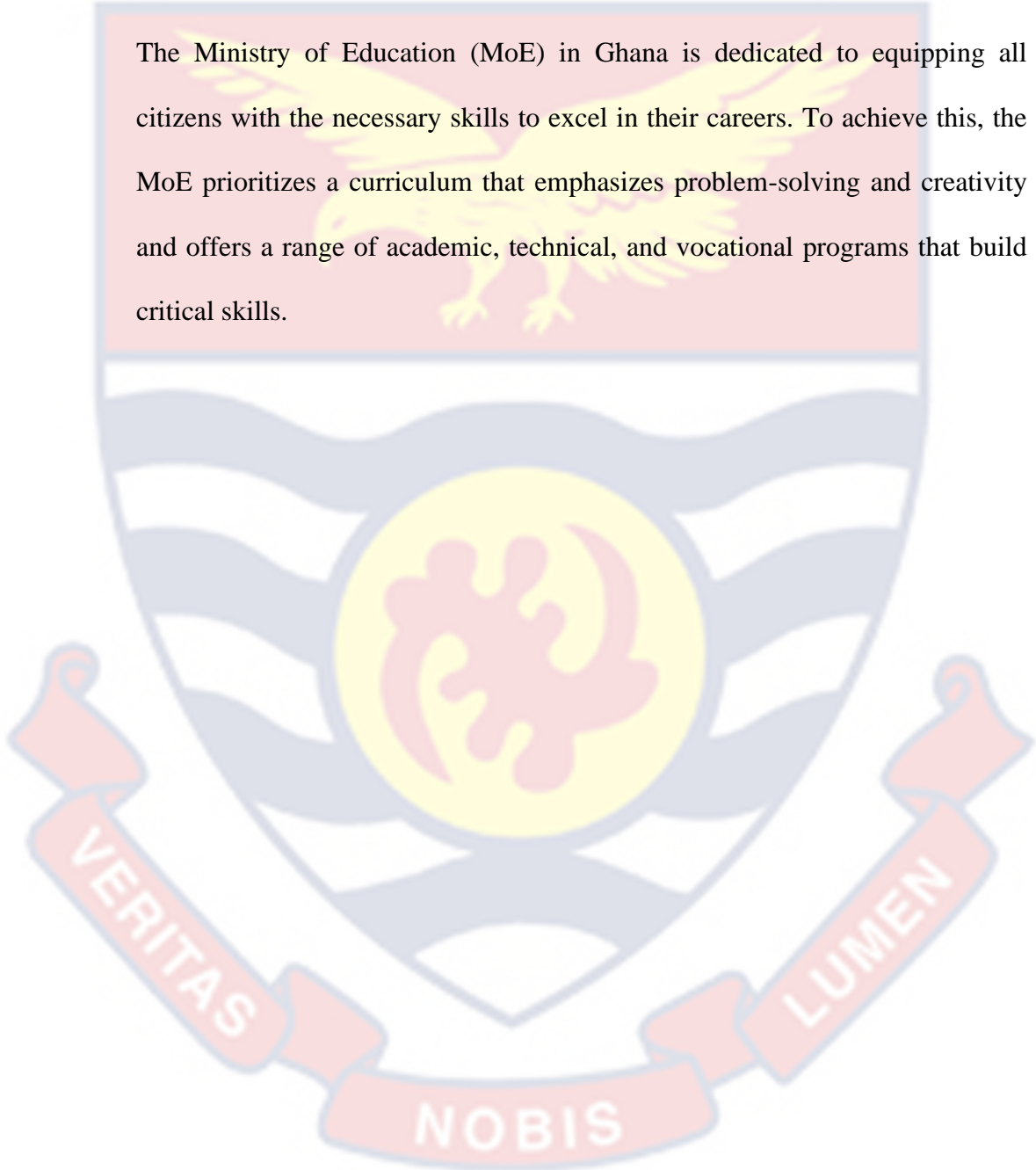
CHAPTER THREE

METHODOLOGY

Introduction

This chapter focuses on the techniques and methods used to conduct the research. It will introduce the research model, approach, design, population, sample size, sampling technique, measurement of variables, data collection tools, data collection, processing and analysis procedures. data analysis, validity and reliability as well as ethical considerations. In addition, it will illustrate the information collection and review process. This segment delves into the focus groups that have been investigated.

Research Paradigm

The research paradigm is crucial for any scientific research (Creswell, 2014). The four main streams in this domain are positivism, interpretivism, pragmatism, and realism research philosophies. The investigation will adopt the positivist paradigm. The positivist paradigm, which asserts that only data obtained from observation and measurement, including the process of measurement, is dependable, was employed in the study (Park, Konge, & Artino, 2020).

Research Approach

The methodology employed in research can take on different forms, such as categorical, numerical, or mixed. In this particular research, the quantitative and qualitative methods were utilized. The primary objective of this approach was to regulate the correlation between a controlled variable and

30

a measured or outcome variable in a population. Through quantitative analysis, the researcher can accurately depict variables that can be quantified with numerical values (Abuhamda, Ismail, & Bsharat, 2021).

Research Design

In essence, a study can adopt an exploratory, descriptive, explanatory, or causal approach in its design. The current study employed the explanatory research design, which enables the identification of the causal relationship between one or more controlled variables and one or more measured variables (Siedlecki, 2020). Furthermore, this design furnishes proof of causal connections and eliminates alternative explanations.

Study Area

Nsawam/Adoagyiri municipality is situated in the southeastern part of the Eastern Region, approximately 23km from the national capital, Accra, and covers an area of about 175 square kilometers.
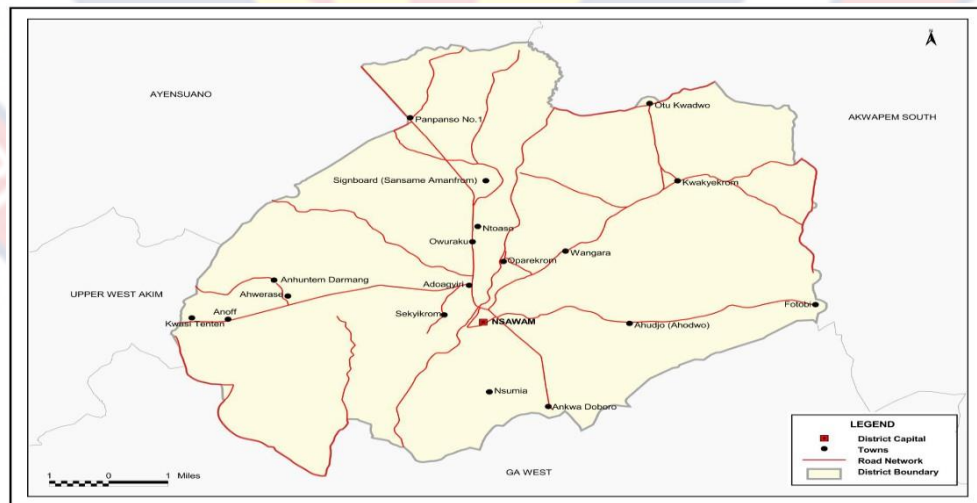
Source: Ghana Statistical Service District Report (2010)

Figure 1: A map of Nsawam/Adoagyiri Municipality

31

In terms of spatial interaction, it is bordered by the municipalities of Ga West and Ga East in the Greater Accra region and to the north by the district of Akuapem to the south. It also shares borders to the northwest with Ayensuano District and to the southwest with Upper West Akim District. The municipality's proximity to Accra and Tema offers development potential. For example, the Accra-Tema municipality is the largest market in the country and provides an easy market for its agricultural and industrial products. So, for example, the Commune could support gardening in the market within the framework of agricultural development. The capital Nsawam is an intermediate town located along the main road connecting the coastal land with the northern part of the country, namely the Accra-Kumasi Road. This presents opportunities for the city's commercial activities, especially the marketing of bread and pastries.

The municipality of Nsawam/Adoagyiri has a population of about 155,597, of which 76,417 men and 79,180 women, respectively, according to the 2021 census and housing report. Its population density is 465. per km². Population growth rate is estimated at 1.6%/year, lower than the national rate of 2.7% but slightly higher than the population growth rate of 1.4%/year in the region. Population structure by age and sex affects fertility, mortality, migration, and other demographic processes that underlie population growth and, ultimately, socioeconomic development. The municipality is also dominated by the Akuapems, which account for about 63% of the population. Ewes account for about 9%, Ga-Adamgbes for 7% and Akan people other than

32

Akuapems for 17%. The remaining 4% came from other tribes, including Northern and other tribes. The Akan domination created the ideal social cohesion for community development.

In particular, the settlement pattern is heavily influenced by the road network, with settlements scattered along the main roads leading to Nsawam and along the railway lines linking Accra to the oil-producing hinterland, cocoa and gold. Agriculture is the main economic activity that creates jobs and generates income in urban areas. Data collected in the field shows that the majority of the population is working (about 37%) engaged in agriculture. About 40% of this population are women and men make up about 60%. The main crops produced in this municipality include corn, cassava, bananas, cocoa, coffee, oil palm, citrus, cola, pineapple, papaya, cashews, etc. The overall effect of all of this is to raise the overall productivity and output in all sectors of the local economy in particular and the macroeconomy as a whole. Aware of this fact, Nsawam/Adoagyiri City Council has considered education as one of the key issues in human resource development. The municipality has a total of 265 Basic Schools (78 public and 187 private), two (2) Public Senior High School and one (1) Private Senior High School with a teacher population of about 1757.

Population

The study's population comprises the target group from which the study aims to extrapolate its conclusions (Stratton, 2021). Furthermore, it serves as the sampling framework from which the sample is selected. For this

research, the target population consisted of all 265 headteachers, 8 SISOs, the 5 member EMIS team and 1 ICT Coordinator within the Nsawam/Adoagyiri Municipality.

Sample and Sampling Technique

Studies that are quantitative typically require a well-represented sample to ensure generalizability (Bloomfield & Fisher, 2019). The sample serves as a representation of the population that is being studied. However, sampling involves selecting groups of interest from which information can be gathered for population identification. Purposeful sampling is applied to select respondents as the survey unit for the study. This approach is taken because the researcher needs to focus on the key people who are interested in the study. The population frame includes all teachers and principals in the area from which the sample size was drawn. In addition, convenience sampling technique was applied to select students for the interview sections. Through convenience sampling, the respondent's readiness and availability was taken into account.

This method was chosen for its cost effectiveness and speed of delivery. However, there is likely to be a bias in favor of certain segments of the population, because the investigator focused on people who were easily accessible and willing to participate in the study. To minimize the possibility of bias in this study, participants who were available and available at the time of the survey, when the researcher visited selected schools, were given the opportunity to respond. To calculate the total used for the sample size, a

34

mathematical formula applied by Brewer and Miller (2003) was used. Formula says:

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

Where n = Sample Size

N = Population

∞ = Margin of Error (10%)

Table 1: Population and Sample Size

Respondent	Total Number	Sample
Headteachers	265	89
SISOs	8	5
EMIS Team	5	5
ICT Coordinator	1	1
Total	**279**	**100**

Source: Field Survey (2023)

Data Collection Instrument

The research utilized original data obtained by administering a structured questionnaire. The questionnaire was considered as the instrument of choice since it allows for self-reporting while ensuring privacy, thus increasing the likelihood of obtaining honest responses regarding the information sought from the participants (Brace, 2018). The survey includes both open and closed questions. There are also dichotomous questions that

35

require a yes or no answer. Open-ended questions allow respondents to express their views and comments on the research questions. With closed-ended questions, respondents have a range of options to choose from without the opportunity to express another opinion or comment on the topic. The questionnaire was divided into three (3) aspects which corresponded with the research objectives. Carefully crafted questions were asked under the various aspects in order to solicit for the right answers that corresponded with the research objectives. The first aspect of the question had demographic questions which included gender, role of the respondent and number of years in the service. Again, there were questions on the availability of MDCT in GES. The second aspect also had questions on the assessment of the technical, structural and financial capacity within GES for an efficient and effective MDC system. The final aspect of the questionnaire had questions on the plan of action to strengthen the existing MDCT in M&E in the Education sector. In order to reduce errors in the responses from respondents and also for the purpose of the research, closed-ended questions were provided to respondents to choose their most preferred choices though few open-ended questions were also asked.

Data Collection Procedure

The questionnaires were transformed into a Kobo Collect link and sent to respondents via email and WhatsApp platforms. The Kobo Toolbox online server was configured to host and store the data sent from the respondents. For the WhatsApp platforms, the Municipal Education Directorate created one (1) for headteachers and SISOs for the purpose of dissemination of information.

36

As for the EMIS team, the researcher had their email addresses. A guide to the questionnaire was also attached to give clarification to some specific questions to reduce errors in the responses.

Data Processing Mode and Analysis

The survey data was entered, and the results were analyzed, and presented using Microsoft Excel 2019. This software was again used to perform statistical calculations such as frequencies and percentages. Charts, graphs and other infographics used for data visualization were also presented using Microsoft Excel 2019. The data was arranged to ensure that it accurately reflected the intended demography in order to facilitate objective analysis. Before assigning numerical values that represented the various features being measured, the replies were further evaluated for correctness. Descriptive statistics were used for the respondents' demographics and the initial descriptions of the various variables.

Ethical Considerations

Research ethics are compassionate and delicate. High regard was given to the various ethical issues in research. Respondents were given the option to participate or decline without any pressure. Furthermore, there was a guarantee that all answers would be kept non-public and anonymous and that the study would be used strictly for academic purposes.

37

CHAPTER FOUR

RESULTS AND DISCUSSIONS

Introduction

The journey to unravel the complexities of the Assessment of the Utilization of Mobile Data Collection Technology; A case study in GES brought a lot of data gathered through the administration of digital questionnaires. This chapter is the keystone of the research which presents the culmination of rigorous research, experimentation, and data collection. The discussions in this chapter focuses on the demographics and the three (3) thematic objectives of the study starting from ascertaining the MDC system available for M&E within GES, assessing the technical, structural, and financial resource capacity within Ghana Education Service for efficient and effective mobile data collection in M&E systems through to assessing the plan of action to strengthen the existing mobile data collection technology in M&E in the Education Sector.
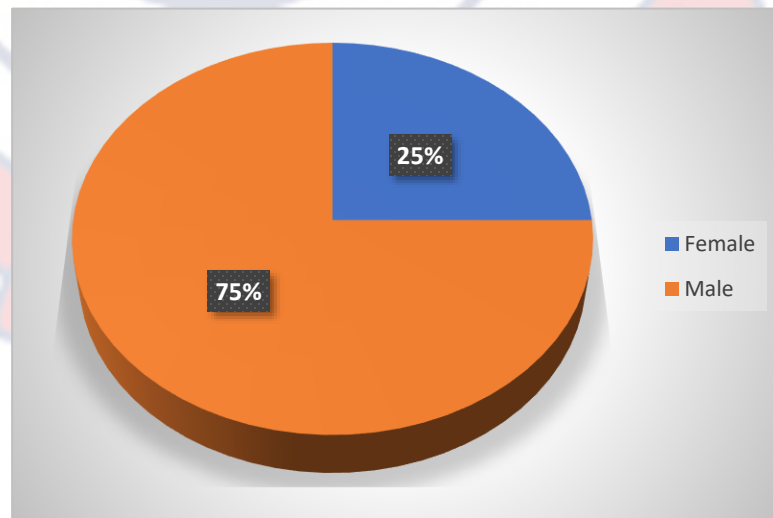
Demographics

Figure 2: Gender

Source: Field Survey (2023)

The figure above which displays the gender of the respondents indicates that 75% of them were males whereas 25% were females summing up to a total of 100%.

Table 2: Role of Respondents

Role of Officer	Frequency	Percentage (%)
EMIS Officer	5	5
I.T Officer	1	1
Headteacher	89	89
SISO	5	5
Total	**100**	**100**

Source: Field Survey (2023)

From the table above, it can be seen that five (5) respondents representing 5% were EMIS Officers, one (1) I.T Officer representing 1%, eighty-nine (89) Headteachers representing 89% and five (5) SISOs also representing 5%.

Number of Years in the Service
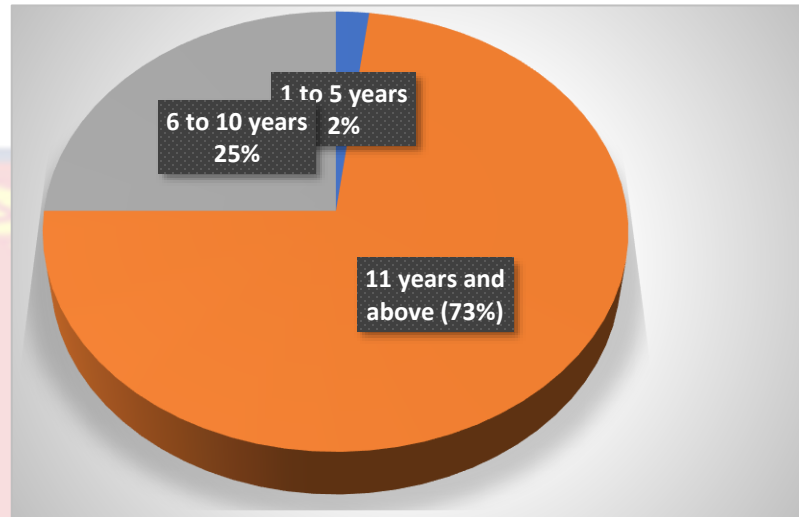
Source: Field Data (2023)

Figure 3: Number of years in the service

From the chart above, it indicated that respondents who have taught for 1-5 years were two (2) representing 2%, twenty-five of them had also taught for 6-10 years which represents 25% and 73% of them also responded that they had taught for eleven (11) years and above.

40

**Research Objective 1: Availability of MDCT for M&E within GES**

Presence of M&E Unit at the various levels
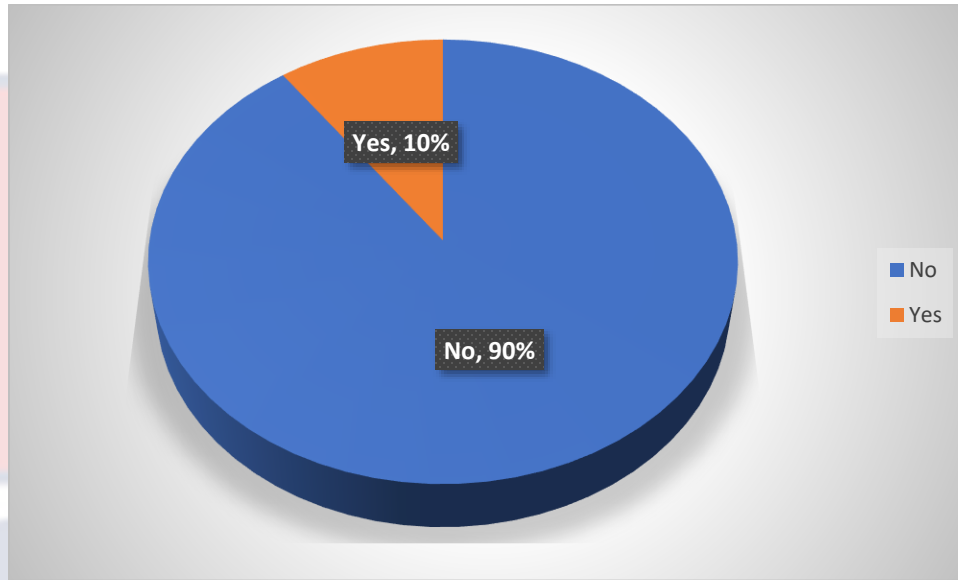
 Source: Field Data (2023)

Figure 4: Presence of M&E Unit (National)

The diagram above indicates that 90% of the interviewees mentioned that they were not aware that G.E.S has an M&E unit at the National Level whereas 10% of them also responded 'Yes' to the question which indicated that they had knowledge of the existence of an M&E unit at G.E.S National.

Source: Field Data (2023)

41
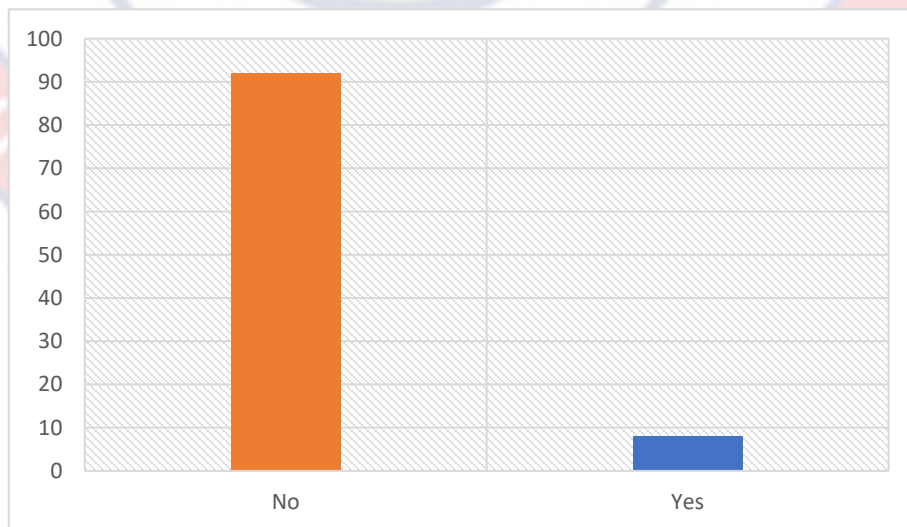
Figure 5: Presence of M&E Unit (Regional)

The graph above shows whether the respondents were aware of the existence of an M&E unit at the G.E.S Regional Level. Apparently, only 8% of the responders knew of the existence of an M&E unit, while 92% of the interviewees also said that they were not aware of the existence of this unit.
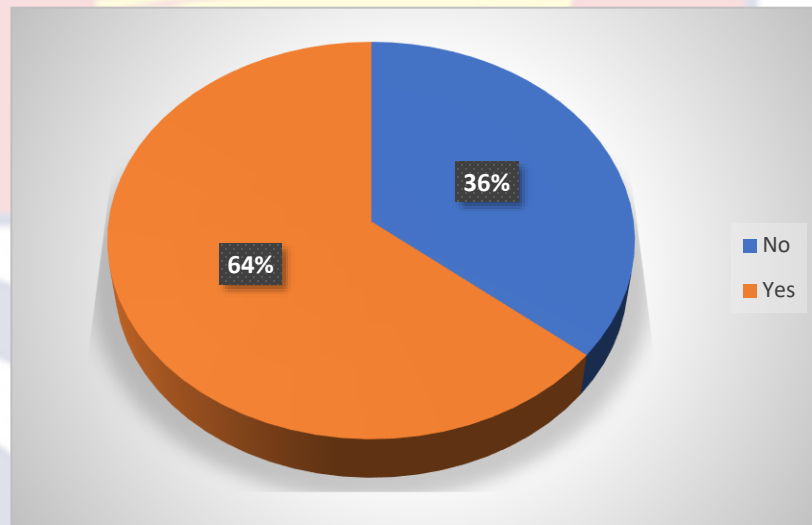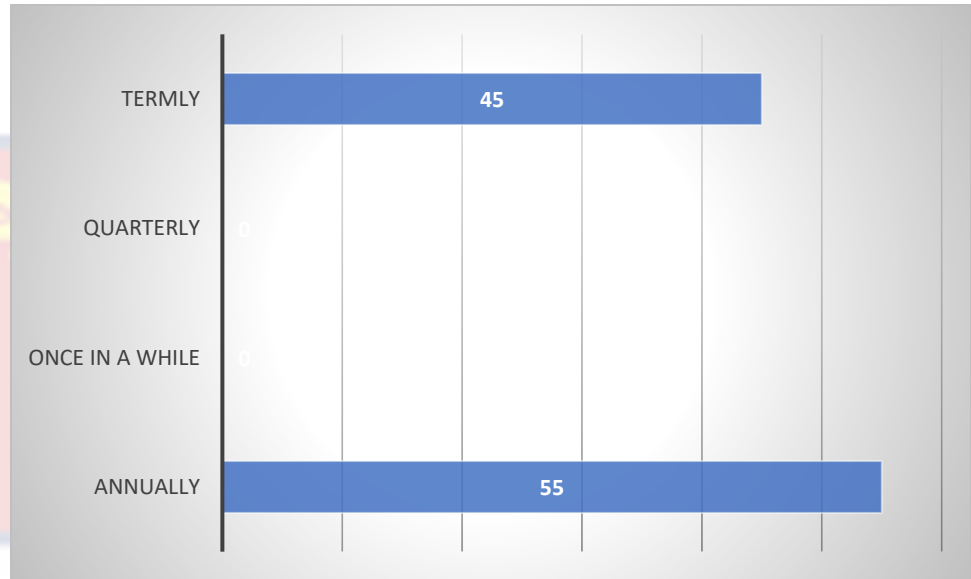

Source: Field Data (2023)

Figure 6: Presence of M&E Unit (District)

From the table above, it can be seen that 64% of the respondents indicated that 'Yes' they were aware of the existence of the M&E unit at the District Level whereas 36% of them also responded 'No'.

42

Data Collection Frequency

Source: Field Data (2023)
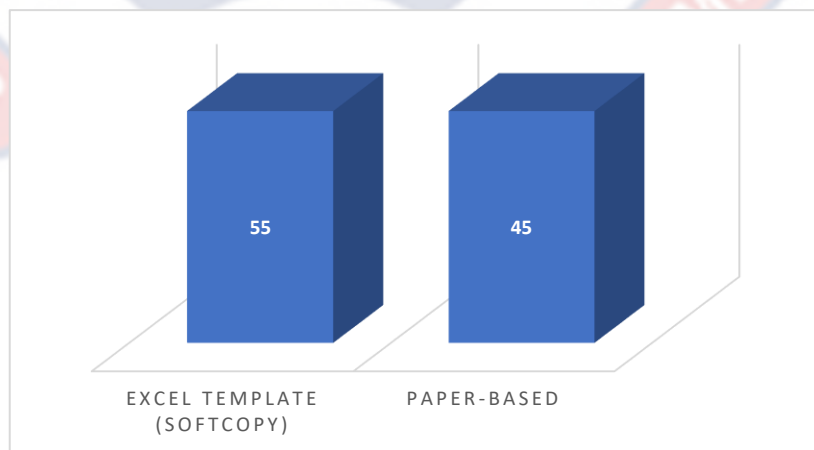
Figure 7: Frequency of Data Collection

Considering how often data is in G.E.S, none of the respondents indicated that data was collected 'Once in a while' and 'Quarterly' respectively which indicates 0% whiles 55% of them responded that data was collected annually and the remaining 45% also indicated that data was collected on 'Termly' basis.

Means of Data Collection

43

Source: Field Data (2023)

Figure 8: Means of Data Collection

With regards to the graph above, it can be seen that the means of data collection centred around 'Excel Template' and 'Paper-Based.' It could be seen that 55% of the respondents chose 'Excel Template' as the means of Data Collection whereas 45% also indicated that 'Paper-Based'.

Data Collection App Available
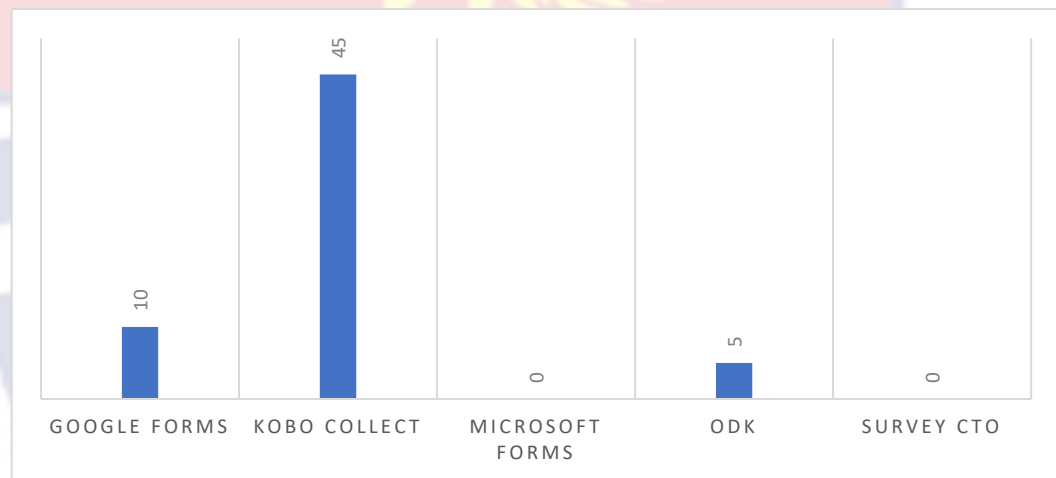
Source: Field Data (2023)

Figure 9: Availability of MDC in G.E.S

From the chart above it could be seen that 'Kobo Collect' was predominant in G.E.S though 45% of the respondents mentioned. 'Google Forms' and 'ODK' represented 10% and 5% respectively whilst 'Microsoft Forms and Survey CTO both recorded 0% each.

Comparing the two (2) data collection systems, which one do you prefer?

On this question, a significant number of respondents totaling 92% indicated that their preferred data collection system was 'Mobile Data Collection'

44

whereas only 8% also responded that they preferred 'Paper-Based and Templates'. Further analysis has been shown in the table below;

Table 3: Data collection systems

Data Collection System	Frequency	Percentage
Mobile Data Collection	92	92
Paper-Based and Templates	8	8
Total	**100**	**100**

Source: Field Data (2023)

Table 3: Preferred Data Collection System

Data Collector

On the issue of who collects data at the school level, all respondents representing 100% indicated that it is the sole duty of the headteacher. Further analysis and interpretation can be seen in the figure below;
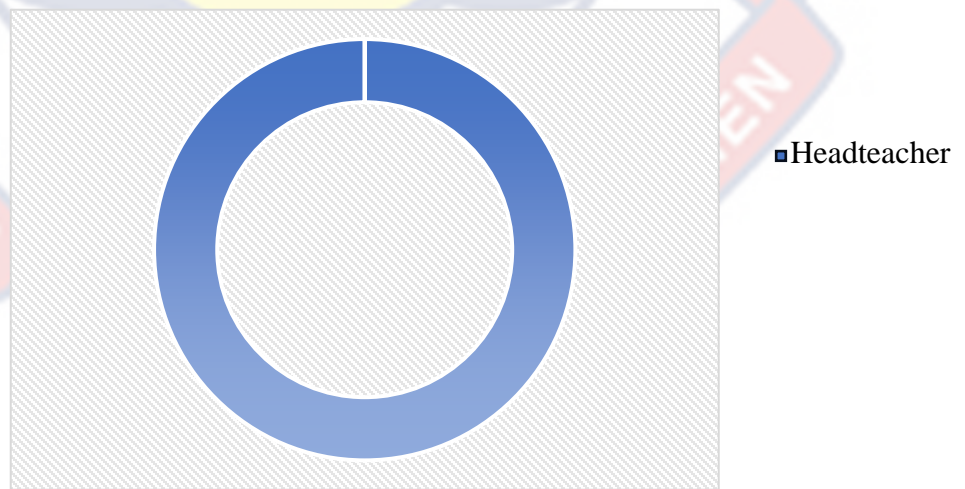
Source: Field Data (2023)

Figure 10: Data Collector

45

The key findings based on the research objectives indicated that 55% responded that Excel Template (Softcopy) was available whereas 45% selected Paper-Based as the means of collecting data. Again, accessing which MDC application GES uses currently, all respondents representing 100% responded No which indicated that Kobo Collect, ODK, Google forms, Survey CTO and Microsoft forms are all not being used by GES for the purpose of MDC. On whether the feedback is received after data submission is done, all respondents representing 100% indicated that No feedback is gotten after data has been submitted. Also, comparing which DC system is preferred, 92% of the respondents chose MDC whereas 8% of them also selected Paper-Based and Templates as a preferred choice.
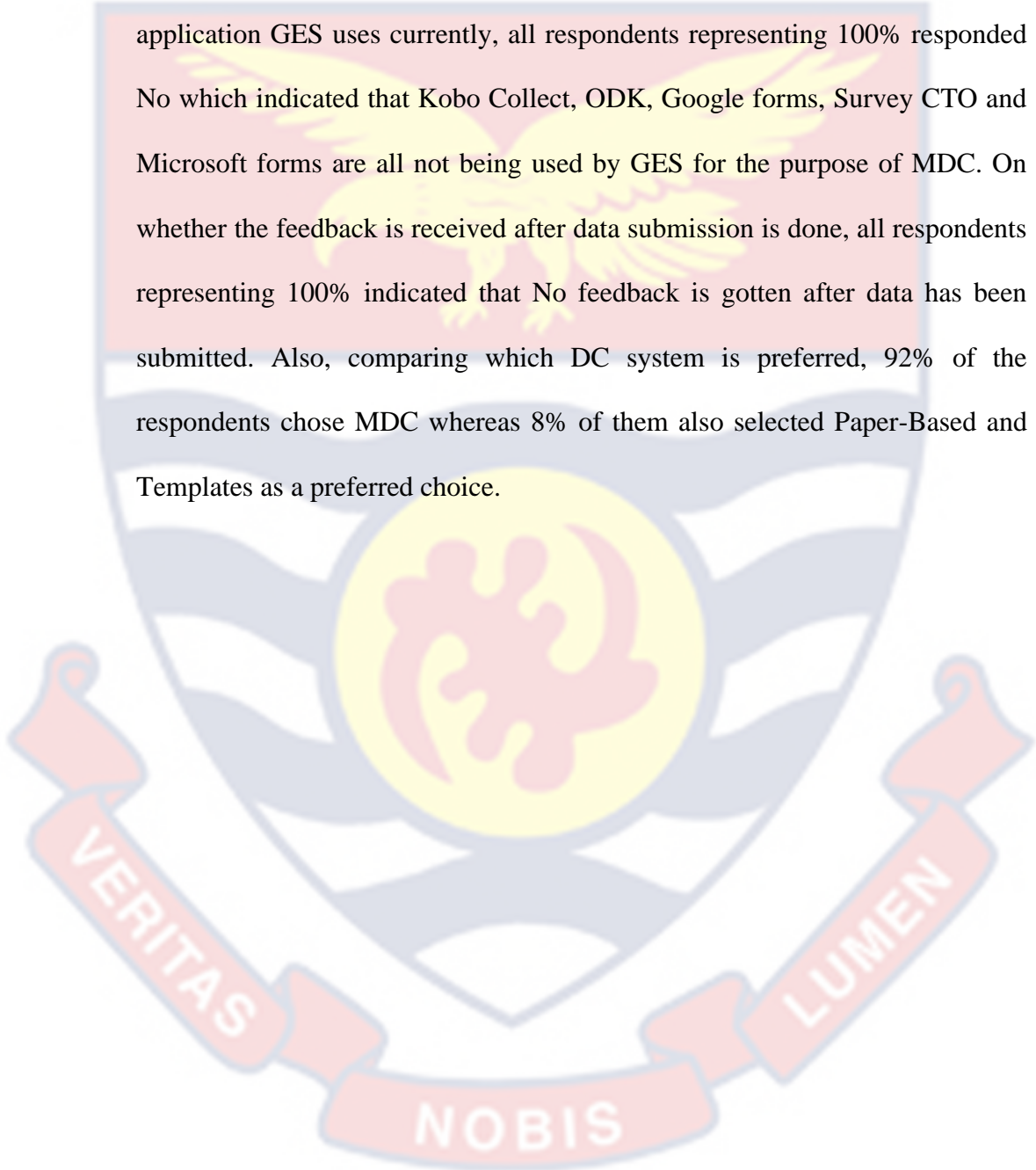
Research Objective 2: Assess the technical, structural, and financial resource capacity with GES for efficient and effective MDC in M&E systems.

Availability of Data collection officers at the various levels
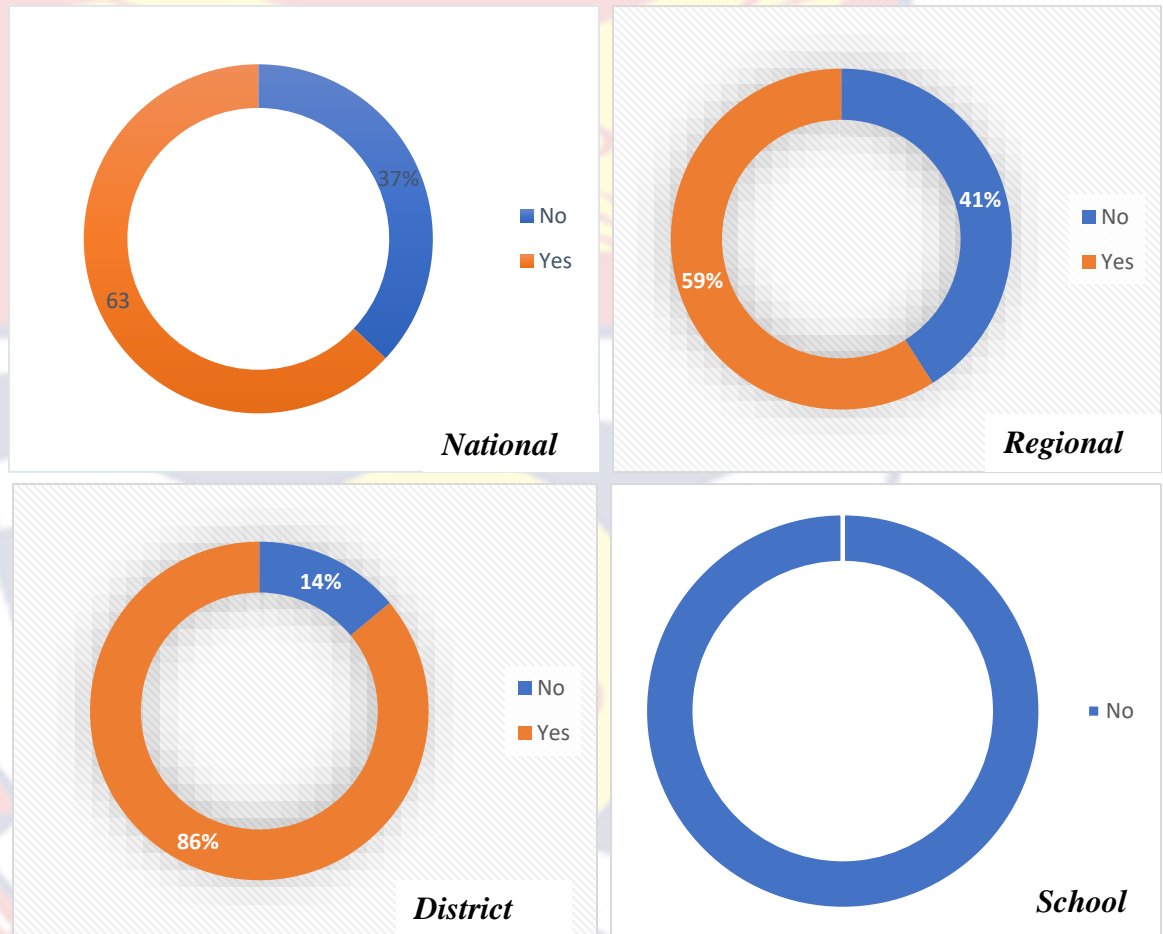
Source: Field Data (2023)

Figure 11: Designated data collection and analysis officers at the various levels

The figure above seeks to identify the existence of designated data collection and analysis officers at the various levels in G.E.S from the part of National, Regional, District and School levels. At the 'National' level, 63% of the respondents responded that indeed they are aware of the existence of

47

designated officers for data collection and analysis whereas 37% of them indicated otherwise. For the 'Regional' level, the responses were 59% and 41% for Yes and No respectively. There was an increase in the percentage for the 'District' level where the majority of the respondents representing 86% indicated they were aware of the existence of the said officers while 14% also responded otherwise. Also, for the 'School' level, all respondents responded negatively which indicated that there were no designated officers for data collection and analysis.

Capacity to perform their assigned roles

Source: Field Data (2023)

Figure 12: Capacity to perform their assigned roles

From the figure above, it could be deduced that 85% of the respondents indicated that though the officers existed at some levels, the majority of them did not have the capacity to perform their assigned roles while 15% of the respondents also indicated that the assigned officers had the capacity.

48

Training on the use of Mobile Data Collection Technology

From the diagram below, it could be deduced that all respondents representing 100% indicated that none of the designated officers have been trained on the use of MDC.
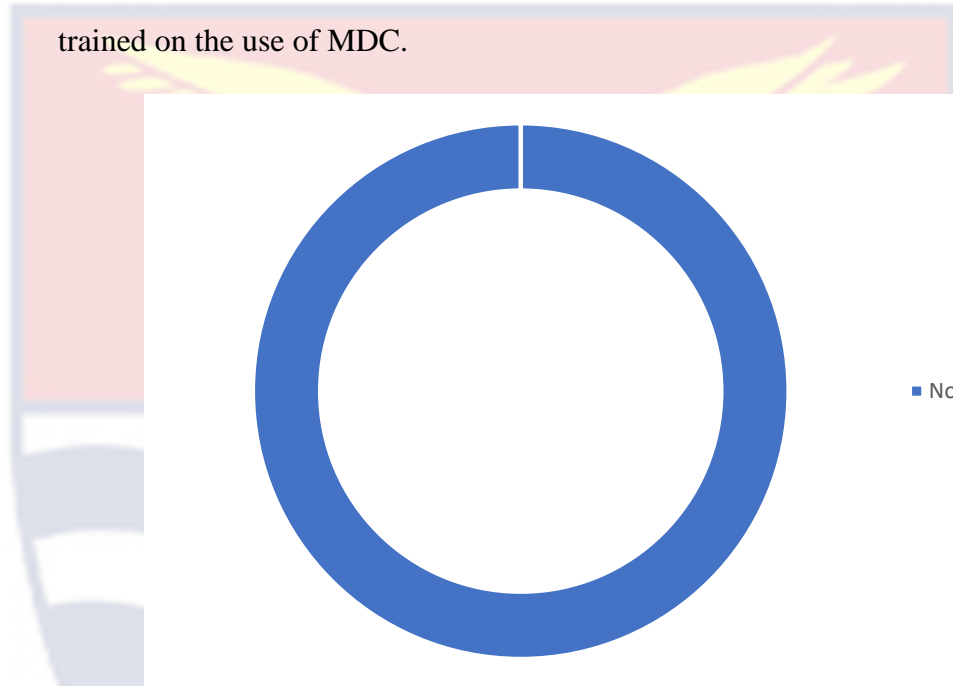
Source: Field Data (2023)

Figure 13: Training on Mobile Data Collection Technology

Budgetary Allocation for MDC Activities?

With regards to whether the designated officers have access to budget for the MDC activities and the response collected and collated revealed that budget was not available. This can be depicted in the figure below.

49
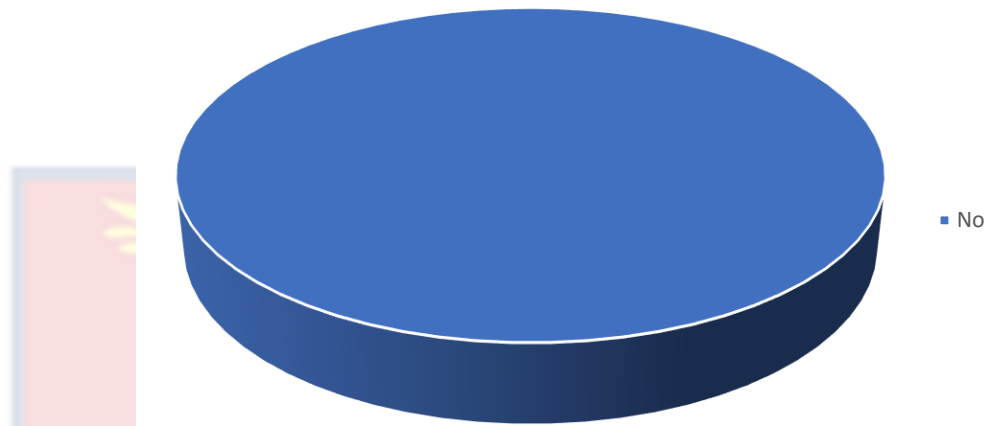
Source: Field Data (2023)

Figure 14: Budgetary Allocation for MDC Activities

Research Objective 3: Assess the plan of action to strengthen the existing mobile data collection technology in M&E in the Education Sector

Strategies and way forward for Mobile Data Collection in G.E.S.

On the subject above, the responses collated from the respondents focused on the Institution of a proper Monitoring and Evaluation System, the Creation of a Remote Data Storage System where data can be accessed anytime, select the required designated officers for MDC at the various levels, and allocate budget for MDC and M&E activities.

Summary

From the general discussions of the above data, it could be deduced that there was no available MDCT in GES and that data collectors resorted to the use of Excel Templates and Paper-based data collection systems. Also, the technical, structural and the financial capacity for effective and efficient MDC system needed to be restructured. Furthermore, the plan of action to strengthen the

50

existing MDCT in M&E in Education depicted that there should be the

institution of a proper MDC system.

51

CHAPTER FIVE

SUMMARY, RECOMMENDATIONS AND CONCLUSION

Introduction

This chapter provides an overview of important discoveries from this research. It will also conclude the research by summarizing the key research findings in relation to the research aims and research questions, as well as the value and contributions thereof. The chapter also explores the limitations of the study and proposes recommendations for instituting and strengthening Mobile Data Collection Technology in Ghana Education Service – Nsawam/Adoagyiri Municipality.

Summary of Key Findings

This study aimed to assess the utilization of Mobile Data Collection technology in GES. From the research, it came to light that the assessment of the utilization of Mobile Data Collection technology in education is a critical exploration of the transformative impact of mobile technology on modern educational practices. This topic investigates how mobile data collection technology is leveraged within educational settings to gather, analyze, and apply data for informed decision-making and enhanced learning outcomes. Mobile Data Collection technology refers to the usage of portable gadgets such as smartphones and tablets to gather various forms of educational data, including student performance, engagement, attendance, and other relevant metrics. This technology has introduced a paradigm shift in education,

52

enabling educators, administrators, and policymakers to access real-time data insights, personalize instruction, and implement timely interventions.

The assessment delves into the multifaceted benefits of adopting Mobile Data Collection technology. The key findings based on the research objectives indicated that, on the availability of Mobile Data Collection technology, 55 respondents representing 55% responded that Excel Template (Softcopy) was available whereas 45 respondents also representing 45% selected Paper-Based as the means of collecting data. Again, accessing which MDC application GES uses currently, all respondents representing 100% responded No which indicated that Kobo Collect, ODK, Google forms, Survey CTO and Microsoft forms are all not being used by GES for the purpose of MDC. On whether the feedback is received after data submission is done, all respondents representing 100% indicated that No feedback is gotten after data has been submitted. Also, comparing which DC system is preferred, 92% of the respondents chose MDC whereas 8% of them also selected Paper-Based and Templates as a preferred choice.

The second research objective discusses the assessment of the technical, structural and financial capacity within GES for an efficient and effective MDC system. From the data collected, it came to light that all respondents representing 100% responded that it is only Headteachers who collect data at the school level. Also, 77% of the respondents responded that the data collected by the headteachers is submitted to the EMIS District Level whereas 33% of the respondents also indicated that headteachers' data

53

collected is sent to their SISOs. In addition, all respondents responded that the data collected is stored Offline. This indicates that all the data collected are kept on a local storage system which makes it inaccessible most of the time and when the power goes out. On the issue of whether GES has designated data collection and analysis officers at the various levels, 41% each responded that G.E.S has no officers responsible for the collection and analysis of data at both National and Regional levels whereas 59% also responded that there are officers in charge of data collection and analysis at the levels.

At the district level, 86% of the respondents indicated that there are officers in charge of data collection and analysis while the remaining 14% responded that such officers do not exist at the district level. For the school level, all the respondents representing 100% mentioned that there are no officers in charge of data at that level. On the issue of whether the designated officers have the capacity to perform their roles, 15% of the respondents selected 'Yes' indicating that the officers have the capacity to perform their roles but a significant majority of them representing 85% also responded 'No' indicating that the officers do not have capacity to perform their roles. All respondents representing 100% responded 'No' to the fact that the designated officers have not been trained in Mobile Data Collection, they do not have access to budget for MDC activities and the fact that the officers in charge of MDC have no clear-cut roles and responsibilities on their appointment letters.

In addition, 92% of the respondents indicated that data collection systems do not have a regular training plan whereas 8% of them also mentioned that the officers have a regular training plan.

Furthermore, the third research objective was to assess the plan of action to strengthen the existing mobile data collection technology in M&E in the Education Sector. One aspect of this research objective was to look at some challenges of Data Collection in Ghana Education Service. Upon gathering responses from the respondents, the predominant challenges mentioned were the collection of the same data severally, poor internet access, financial constraints, inadequate training for data collectors, inadequate trained personnel, untimely data submission, no proper data collection system and unavailability of an M&E system. After exploring the challenges of DC in G.E.S there was the need to also delve into what suggestions can be made to improve the MDC system in G.E.S.

Out of the responses collected and collated, the predominant ones were; there should be the composition of a proper M&E system, training of designated staff on MDC, tools and logistics must be provided and there should be a proper data collection system. Also, some responded that there must be a well-structured plan for training for data handlers at all levels.

Recommendations

The following were recommended based on the findings:

- GES should resort to the usage of Mobile Data Collection since it offers numerous advantages that make it a preferred choice for many organizations and researchers. It also reduces the risk of human error during data entry. With built-in validation checks and automated field formatting, it helps maintain data accuracy and integrity.

- GES should have an online repository for remote data storage. Also, this data should be made readily available and accessible to all the various levels of data collection. This makes stakeholders at the grassroots get access to data for decision-making at their level.

- There should be designated officers with the technical know-how at the various levels within GES to handle data analysis and data-related issues. These individuals must have clear-cut job schedules in order to know their scope of work.

- There should be intermittent training and capacity building for the designated officers to equip themselves with the current trends in data handling.

- GES should have a budgetary allocation for M&E activities and the budget must be readily accessible to the required staff for the implementation of their activities.

- There should be composition of a proper M&E system within the Education Directorate. Below is a system the Municipality can adopt;

56

Institutional M&E Capacity Building Work Plan

Capacity concerning performance encompasses five (5) major topical areas: Job expectations, performance feedback, physical environment, motivation, knowledge and skills. To develop the Monitoring and Evaluation (M&E) capacity within the ministry, it is important to identify the main contributions to M&E approaches and to formulate strategies to address competency needs within the Municipality to manage the M&E approaches. The action points below outline the strategy for building institutional M&E capacity for Ghana Education Service, Nsawam/Adoagyiri Municipality.

Action Point 1: Hold consultations with stakeholder categories to initiate the M&E system development process

Rationale: The different levels of responsibilities for key personnel that will influence the M&E development process have to be involved before the onset of activities. Ranging from the highest authorities within the Municipal Education Directorate to the first level data management process, the M&E team must have direct interactions to introduce and outline the system development process as well as solicit their input/support for the strategy. This will enhance their commitment to the ownership of the M&E system when it is finally developed and make them feel responsible for its implementation.

 Approach: The M&E system development strategy will be broadly outlined during consultations with each stakeholder group. Specific points that fall within the purview of each stakeholder group will be discussed as follows:

Municipal Director & Management:

- Solicit input and authoritative commitment

- Request for M&E champion(s) at the ministerial level

The EMIS Team:

- Solicit input and commitment

- Request M&E point person(s)

- Set up M&E capacity assessment schedules

SISOs:

- Solicit input and commitment

COHBS:

- Solicit input and commitment

Expected Results: It is expected that through these consultative meetings, all stakeholders will have a clear understanding of their responsibilities for the municipality's M&E system development. This will invoke their commitment to provide continuous support at their various levels for the accomplishment of this task.

Expected Challenges: One key challenge for this action point is the unavailability of stakeholders especially at the Municipal Office level for consultations due to their very busy schedules. The 'voice' of the Municipal Director in the quest for the commitment of all stakeholders is vital to the success of this task.

58

Action Point 2: Conduct M&E Capacity Assessments

Rationale: Setting up a Monitoring and Evaluation system requires knowing what components of the system and capacity already exist. This will serve as a reference/foundation upon which to build the system. Knowledge of the existing capacity of the ministry to absorb each component of the M&E system for effective implementation will inform strategy formulation in the development of the M&E system. Conducting M&E assessments will unearth critical information for such strategies.

Approach:Separate capacity assessments will be conducted for each sub-reporting entity from the Municipal Education offices to the schools and communities. The assessments will cover three (3) main themes of capacity building. These are:

- Human resource capacity in terms of M&E technical skills and the numbers of existing manpower;

- Institutional resource capacity in terms of equipment and logistics including funding required for undertaking M&E activities;

- Facilitating the environment in terms of institutional arrangements that determine the level of authority and responsibility assigned to specific staff to carry out M&E activities.

Provisional work plans on activities to be undertaken for developing M&E capacities will be formulated with each stakeholder group as part of their assessment process.

59

Expected Results: A comprehensive report on the assessment of GES, Nsawam/Adoagyiri M&E capacity will be prepared and disseminated to appropriate recipient categories. Strategic meetings will be held to discuss recommendations made in the report and the possible implementation approaches to M&E system development within the municipality.

Expected Challenges: Conducting M&E capacity assessments require focus and concentration. The foreseeable challenge here is not having continuous availability of staff members throughout the periods of meeting with each stakeholder group.

Action Point 3: Develop an M&E framework

Rationale: The structure that outlines the M&E strategy in broad terms lays the foundation upon which the institutional arrangements would be defined and the M&E activity implementation guide developed. This broad 'skeleton' (framework) is needed to display how the different components and sub-components of the M&E system will fit together and establish the flow of data/information and feedback as well as the institutional arrangements on M&E responsibilities. The M&E framework forms the basis of developing the M&E system and M&E plan for the Education Directorate.

Approach: The following steps will be undertaken to establish the M&E framework for the GES, Nsawam/Adoagyiri:

Review existing M&E documents/arrangements/frameworks:

- ESP documents

- NGO M&E frameworks

Formulate draft institutional M&E framework:

- Develop a draft M&E framework for the EMIS team

- Disseminate draft M&E framework to each sub-reporting entity and partners for input

Hold consultative sessions

- Meet with each stakeholder group to discuss the draft M&E framework and build consensus.

Finalize M&E framework:

- Incorporate all inputs from consultative meetings into the frameworks and finalize

- Submit the final framework to the Municipal Director of Education for endorsement

- Disseminate framework to all stakeholders

Publicity:

- Launch M&E framework (internally)

- Post M&E framework chart on all notice boards (including schools)

Expected Results: The GES M&E framework outlining the broad M&E strategy as well as the M&E framework with sub-reporting levels will be available at the Registry and EMIS department. Members of staff will have ownership of the framework due to their keen participation withinside the development.

61

Expected Challenges: Lack of interest or unavailability of staff members to participate in the development of the M&E frameworks. The voice of the Municipal Director will be critical in the encouragement of staff members to actively participate.

Action Point 4: Develop M&E capacities

Rationale: A functional M&E system demonstrates technical competence when the human, institutional and favorable environment capacity to perform all the tasks of the system is fully developed. The initiative to establish a M&E system should ensure that there is sufficient knowledge, skills, institutional arrangements and an enabling environment to manage the system.

Approach:Results and recommendations from the M&E system assessments conducted will inform the formulation of strategies for effective capacity building. The strategies will involve the systematic development of human resources at the municipality's various levels of responsibility and authority. Each level will have a specific focus on knowledge and skill development modules concerning their levels of responsibility and authority. The M&E team at the GES office will form the core of trainers whose capacity will be built to conduct the M&E sessions for the various levels. The broad themes for M&E capacity development will include the following:

Data Management:

- Indicators

- Instrument design

- Data collection

- Data analysis

- Information dissemination

Monitoring & Supervision:

- Setting up monitoring & supervision frameworks

- Conducting monitoring & supervision activities

- Managing monitoring & supervision data

Evaluation:

- Setting up evaluation frameworks

- Conducting evaluation activities

- Reporting evaluation data

Use of data for decision-making:

- Analyzing and interpreting results

- Linking results to performance standards

- Making data-informed decisions

- Following up on decisions made

63

Computer skills:

- MS-Word

- Excel/PowerBI

- PowerPoint

- ODK/Kobo collect/Google forms

- SPSS

Expected Results: At the end of the process, it is expected that the municipality will put together a core staff with the necessary skills to manage the M&E system and impart the knowledge and skills acquired through training, mentoring and shaping.

Expected Challenges: Lack of staff commitment to undergo training mentoring and coaching sessions as well as the unavailability of resources to conduct capacity-building sessions for all levels of responsibility are likely challenges to be experienced.

Action Point 5: Design M&E system

Rationale: To ensure an efficient monitoring and evaluation system for GES in Nsawam/Adoagyiri, a well-defined and documented structure is necessary. This structure should outline the internal institutional arrangements and how they interact with external stakeholders, as well as the flow of data and information. It is important to establish clear responsibilities and reporting channels. Designing a comprehensive M&E system for the municipality is crucial in providing an overview of the desired operations for M&E.

64

Approach: The participatory process following the stakeholder consultations will incorporate recommendations made for designing the M&E system. Existing systems will be reviewed to identify ways in which interactions enhance M&E operations in the municipality. The following steps will be employed towards designing the M&E system for the municipality:

65

Review existing M&E systems

- GES existing arrangements for M&E

- M&E systems for NGOs working with the municipality

- Existing data flow structure

Develop institutional M&E system design

- Develop M&E system designs for the EMIS team

- Develop M&E system designs for the municipality

- Discuss M&E system designs with each sub-reporting entity for input

Hold consultative sessions

- Meet with stakeholders to finalize their M&E system designs

- Meet management to finalize the M&E system design

Finalize M&E system

- Consolidate all sub-designs into an overall M&E system design.

- Submit the final M&E system design to the Municipal Director for endorsement

- Disseminate M&E system design to all stakeholders

Expected Results: The process is expected to produce a well-defined M&E system design for GES, Nsawam/Adoagyiri through a participatory approach. The involvement of stakeholders in the design will encourage ownership and assure commitment to maintaining the design for its effective operation.

Expected Challenges: Challenges will come from the lack of commitment by staff members as well as NGOs and other stakeholders to participate in consultations and consensus-building sessions.

Action Point 6: Develop an institutional M&E plan

Rationale: To effectively implement M&E activities within the municipality, a documented guide that spells out specific actions and responsibilities for each stakeholder will have to be developed and used as a working tool for this task. This guide (M&E plan) will also outline indicators and data management processes as well as responsibilities for implementing M&E activities.

Approach: The M&E plan development will be based on the M&E framework and M&E system design already developed. Recommendations gathered through the consultative sessions held with each bureau will be added in the M&E plan. At the start, participatory approaches will be used to develop each bureau's sub-M&E plan to guide implementation at that level while the overall institutional M&E plan will be developed to encompass all the sub-M&E plans. Synergies will be enforced amongst the M&E plan development partners and other stakeholders working in the education sector to harmonize all M&E efforts. The steps will include but not be limited to the following:

Review existing docs / M&E plans

- ESP 2018 - 2030

- NGO M&E plans

Prepare draft M&E plan

- Develop draft M&E plans for each reporting unit

- Develop an overall draft M&E plan

- Share draft M&E plan with some reporting units

Hold consultative sessions

- Meet with the various M&E focal persons to discuss the draft M&E plans and build

  consensus

- Hold a sector-wide meeting to discuss the overall M&E plan and build consensus

Finalize M&E plan

- Incorporate all inputs and finalize M&E plans

- Submit the final M&E plan to the Municipal Director for endorsement

- Disseminate M&E plans to the various reporting units

Publicity

- Launch the M&E plan

Expected Results: A document to guide the implementation of all M&E activities – The

M&E Plan – will be produced at the end of the process. The participatory process will

encourage ownership and commitment to the implementation of activities.

Expected Challenges: Challenges expected include the unavailability of staff members to

participate in the process as well as resistance from NGOs and other stakeholders.

Action Point 7: Set up the M&E system

Rationale: After developing the M&E framework, the M&E system design, and the M&E plan, the remaining milestone to effectively implement the M&E activities is to put the necessary conditions and capacities in place. Among other things, setting up the M&E system will require ensuring that human and other resources are in place to support activities to be undertaken.

Approach: The following activities will be undertaken in consultation with each reporting unit (school) as well as the education office as part of activities to set up the M&E system:

Develop TORs & formats:

- Set up M&E positions with TORs appropriately within each unit

- Review existing staff responsibilities and identify M&E tasks

- Review existing data management formats and adapt/update as needed

- Develop new formats for data management as necessary

Define and assign responsibilities with timelines:

- Work with management to define tasks and assign responsibilities.

- Define M&E working relationships for each reporting unit as well as individuals.

Roll out system implementation

- Conduct workshops on

  – M&E processes and responsibilities

  – Data management processes

- Provide mentoring and coaching for M&E activities

Logistics

Ensure that the M&E focal persons in the various reporting units have functional laptops/data/wifi etc to aid their work.

Enabling environment

- Institute internal work planning and regular review sessions for the various unit.

- Create a demand for M&E information to be used for decision making

Expected Results: It is expected that after the process, the necessary capacities in terms of personnel assigned with specific responsibilities as well as logistics and enabling environment will be in place for M&E activity implementation.

Expected Challenges: Challenges expected include insufficient manpower and logistics to undertake M&E activities. Others are the non-availability of funds to continuously undertake M&E activities and the lack of political will to create the enabling environment for personnel to perform their M&E activities.

Action Point 8 : Implement M&E plan

Rationale: To generate credible data for decision-making in the education directorate, the M&E plan will have to be implemented comprehensively at all levels with a very active feedback loop. Commitment at every level of responsibility will require encouragement from the higher authorities and support from sub-reporting levels.

70

Approach: The M&E plan implementation will be participatory at all levels. The corporate responsibilities of internal as well as external stakeholders are outlined below:

M&E Unit

- Provide a definition for institutional relationships regarding the acquisition and distribution of monitoring and evaluation information

- Offer mentoring and coaching assistance to all departments and interested parties.

- Keep track of data management procedures across all levels.

- Perform evaluations of data quality

- Assess how well the monitoring and evaluation system is performing

Reporting Units

- Receive data and submit to the Municipal Director and Management and provide feedback to the reporting units.

- Undertake requisite data analysis for appropriate decision-making

- Use analyzed M&E data/information for decision making

Levels

- Collect data and submit it to management

- Undertake requisite data analysis for appropriate decision making

- Provide feedback to sub-reporting levels

71

Monitoring

- Conduct monitoring of activity implementation

Partners / NGOs

- Foster collaborative relationships in support of M&E activities

Expected Results: Effective implementation of the M&E plan is expected to continuously produce timely and credible data to inform decision-making at all levels of responsibility and authority.

Expected Challenges: Challenges include funding and logistical support to effectively implement the M&E activities to implement the M&E plan.

Action Point 9: Evaluate the M&E system

Rationale: To improve upon implementation strategies of the M&E system, a continuous feedback loop will have to be maintained to inform implementers of the strengths and weaknesses of the system. These will include periodic comprehensive evaluation studies that will serve as institutional learning mechanisms as well as instruments for measuring the M&E system's performance. Information obtained from evaluation studies will be used to develop schemes for strengthening the M&E system.

Approach: The following broad steps will be undertaken to evaluate the municipality's M&E system.

Evaluation design

- Set up evaluation schedules (Baseline, Midline, and End of period).

- Develop evaluation milestones using the five evaluation criteria.

- Develop performance indicators to measure M&E results to be achieved.

Evaluation capacity

Build GES staff capacity to conduct/participate in evaluations.

Evaluation process

- Develop evaluation questions
- Set up data collection methodology
- Arrange with respondents on the data collection schedule
- Conduct evaluation data collection and analysis

Reporting

- Prepare evaluation report.

- Disseminate evaluation report.

- Hold critical reflection sessions with different levels of targeted audience.

Expected Results: Evaluation activities are expected to generate information for decisions to be made for strengthening the M&E system. Strengths and weaknesses of the system will be unearthed and recommendations made appropriately to make the system more effective.

Expected Challenges: Logistical support at the respective levels of authority to participate in evaluation activities, and to use evaluation results for decision-making.

73

REFERENCES

Abuhamda, E., Ismail, I. A., & Bsharat, T. R. K. (2021). *Understanding quantitative and qualitative research methods: A theoretical perspective for young researchers*. International Journal of Research, 8(2), 71-87.

Akinbobola, A. O. & Adeyemo S. A (2021). *Analysis of Mobile Data Collection in Nigeria.* American – Eurasian Journal of Scientific Research. 5(4) 234-240.

Allemand, M., and Mehl, M. R. (2017). *"Personality assessment in daily life: a roadmap for future personality development research," in Personality Development Across the Lifespan*, ed. J. Specht (London: Elsevier Academic Press), 437–454.

Aschwanden, D., Luchetti, M., and Allemand, M. (2018). *Are open and neurotic behaviours related to cognitive behaviours in daily life of older adults?* J. Pers. doi: 10.1111/jopy.12409. [Epub ahead of print].

Axinn, W. G., & Pearce, L. D. (2006). *Mixed method data collection strategies*. Cambridge University Press.

Baker R. P., & Bradburn N. M. (1991). *CAPI: Impacts on data quality and survey costs.* Paper presented at the Public Health Conference on Health and Statistics, July 15–17, Washington, DC.

Barchard, K. A., & Pace, L. A. (2011). Preventing human error: The impact of data entry methods on data accuracy and statistical results. *Computers in Human Behavior*, *27*(5), 1834-1839.

Bartle, P. (2007). *The nature of monitoring and evaluation,* Omega, 29(2): 171-182

Barry, S. J., Dane, A. D., Morice, A. H., and Walmsley, A. D. (2006). *The automatic recognition and counting of cough.* Cough 2:8. doi: 10.1186/1745-9974-2-

Bazeley, P. (2003). *Defining early career in research.* Higher Education, 45(3), 257-279.

Beierle, F., Tran, V. T., Allemand, M., Neff, P., Schlee, W., Probst, T., et al. (2018a*). "TYDR: Track your daily routine. Android app for tracking smartphone sensor and usage data," in Proceedings of the 5th International Conference on Mobile Software Engineering and Systems* - MOBILESoft '18; 2018 May 27–28 (Gothenburg: ACM Press), 72–75.

Bleidorn, W., and Hopwood, C. J. (2018). *Using machine learning to advance personality assessment and theory.* Pers. Soc. Psychol. Rev. 1:1088868318772990. doi: 10.1177/1088868318772990

Boukerche, A., & Fei, X. (2008). Adaptive data gathering protocols with mobile collectors for vehicular ad-hoc and sensor networks. In *IEEE international conference on wireless & mobile computing, networking & communication.* http://doi.ieeecomputersociety.org/10.1109/WiMob.2008.124.

Cartwright, J. (2016). *Technology: Smartphone science.* Nature 531, 669–671. doi: 10.1038/nj7596-669a

Charlton, B., Sall, E., Schwartz, M., & Hood, J. (2011, January). Bicycle route choice data collection using GPS-enabled smartphones. In *Transportation Research Board 90th Annual Meeting, 23-27 January 2011.*

Chen, Z., & Casciati, F. (2014). A low-noise, real-time, wireless data acquisition system for structural monitoring applications. *Structural Control and Health Monitoring*, *21*(7), 1118-1136.

Chen, G. (2011). Mobile research: benefits, applications, and outlooks. In *Internationalization, Design and Global Development: 4th International Conference, IDGD 2011, Held as part of HCI International 2011, Orlando, FL, USA, July 9-14, 2011. Proceedings 4* (pp. 11-16). Springer Berlin Heidelberg.

Claytor, W. G., & Bagnall, R. S. (2015). The beginnings of the Roman provincial census: A new declaration from 3 BCE. *Greek, Roman, and Byzantine Studies*, *55*(3), 637-653.

Creswell, J. W. (2014). *A concise introduction to mixed methods research*. SAGE publications.

Demiray, B., Mischler, M., and Martin, M. (2017). *Reminiscence in everyday conversations: a naturalistic observation study of older adults*. J. Gerontol. B Psychol. Sci. Soc. Sci. doi: 10.1093/geronb/gbx141. [Epub ahead of print].

Dufau, S., Duñabeitia, J. A., Moret-Tatay, C., McGonigal, A., Peeters, D., Alario, F. X., et al. (2011). *Smart phone, smart science: how the use of smartphones can revolutionize research in cognitive science*. PLoS ONE 6:e24974. doi: 10.1371/journal.pone.0024974

Ebner-Priemer, U. W., Koudela, S., Mutz, G., and Kanning, M. (2013). *Interactive*

multimodal ambulatory monitoring to investigate the association between physical

activity and affect. Front. Psychol. 3:596. doi 10.3389/fps.2012.00596

Erbas, Y., Ceulemans, E., Kalokerinos, E. K., Houben, M., Koval, P., Pe, M. L., et al. (2018).

Why I don't always know what I'm feeling: the role of stress in within-person fluctuations

in emotion differentiation. J. Pers. Soc. Psychol. 115, 179–191. doi: 10.1037/pspa0000126

Ghimire, P., Acharya, A., Devkota, C., & Gairhe, J. J. (2021). *Effect of Nitrogen*

Levels on Use Efficiencies and Yield of Wheat at Bharatpur, Chitwan, Nepal. *The*

Geographic Base, *8*(01), 95–108. https://doi.org/10.3126/tgb.v8i01.43477

Goodman, J. K., Cryder, C. E., & Cheema, A. (2013). Data collection in a flat world: The

strengths and weaknesses of Mechanical Turk samples. *Journal of Behavioral Decision*

Making, *26*(3), 213-224.

Groves, R. M., Presser, S., & Dipko, S. (2004). *The role of topic interest in survey participation*

decisions. Public Opinion Quarterly, *68*(1), 2-31.

Gruenenfelder-Steiger, A. E., Katana, M., Martin, A. A., Aschwanden, D., Koska,

J. L., Kündig, Y., et al. (2017). *Physical activity and depressive mood in the daily life of*

older adults. GeroPsych 30, 119–129. doi: 10.1024/1662-9647/a000172

Hamaker, E. L. (2012). *"Why researchers should think 'within-person': A*

paradigmatic rationale," in *Handbook of Research Methods for Studying Daily Life*, eds.

M. R. Mehl and T. S. Conner (New York, NY: Guilford), 43–61.

Harari, G. M., Lane, N. D., Wang, R., Crosier, B. S., Campbell, A. T., and Gosling, S. D. (2016). *Using smartphones to collect behavioural data in psychological science: opportunities, practical considerations, and challenges.* Perspect. Psychol. Sci. 11, 838–854. doi: 10.1177/1745691616650285

Hin, S., Conde, D. A., & Lenart, A. (2016). New light on Roman census papyri through semi-automated record linkage. *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, *49*(1), 50-65.

Horn, A. B., Samson, A. C., Debrot, A., and Perrez, M. (2018). *Positive humour in couples as interpersonal emotion regulation: a dyadic study in everyday life on the mediating role of psychological intimacy.* J. Soc. Pers. Relat. 1–21. doi: 10.1177/0265407518788197

Jagger, P., Duchelle, A., Larsen, H. O., & Nielsen, Ø. J. (2012). Hiring, training and managing a field team. In *Measuring Livelihoods and Environmental Dependence* (pp. 163-174). Routledge.

Kaufmann, K., & Peil, C. (2020). *The mobile instant messaging interview (MIMI): Using WhatsApp to enhance self-reporting and explore media usage in situ*. Mobile Media & Communication, 8(2), 229-246.

Kim, S., Mankoff, J., & Paulos, E. (2013, February). Sensr: evaluating a flexible framework for authoring mobile data-collection tools for citizen science. In *Proceedings of the 2013 conference on Computer supported cooperative work* (pp. 1453-1462).

Kimball, S. H. (2019). *Survey Data Collection; Online Panel Efficacy*. A Comparative Study of Amazon MTurk and Research Now SSI/Survey Monkey/Opinion Access. *Journal of Business Diversity*, *19*(2).

Keengwe, J., Schnellert, G. & Jonas, D. (2014*). Mobile phones in education: Challenges and opportunities for learning*. Educ Inf Technol **19**, 441–450. https://doi.org/10.1007/s10639-012-9235-7

Ladouce, S., Donaldson, D. I., Dudchenko, P. A., and Ietswaart, M. (2017). *Understanding minds in real-world environments: toward a mobile cognition approach*. Front. Hum. Neurosci. 10:694. doi: 10.3389/fnhum.2016.00694

Lavrakas P., Grant B., Blumberg S., Trent B., Flores I. C., Leah C., Dutwin C., Fahimi M., Fienber H., Guterbock T., Keeter S., Kelly J., Courtney K., Peytchev A., Piekarski L. and Shuttles C. (2017). *The Future of U.S. General Population Telephone Survey Research*. AAPOR Report.

Lieberson, S. (1992). *Einstein, Renoir, and Greeley: some thoughts about evidence in sociology: 1991 presidential address*. American Sociological Review, 1-15.

Manfreda, K. L., & Vehovar, V. (2012). Internet surveys. In *International handbook of survey methodology* (pp. 264-284). Routledge.

Marshall, S. and Taylor, W. (2005) *Facilitating the Use of ICT for Community Development*

through Collaborative Partnership between University, Government and Communities. International Journal of Education and Development Using ICT, Vol. 1, No. 1. www.ijedict.dec.uwi.edu/

Mehl, M. R., and Conner, T. S. (eds) (2012). *Handbook of Research Methods for Studying Daily Life*. New York, NY: Guilford Publications, Inc.

Miller, G. (2012). *The smartphone psychology manifesto*. Perspect. Psychol. Sci. 7, 221–237. doi: 10.1177/1745691612441215

Nayak, M. S. D. P., & Narayan, K. A. (2019). Strengths and weaknesses of online surveys. *technology*, 6(7), 0837-2405053138.

Njuguna1 HN., Caselton1 Dl., Arunga GO., Emukule GO., Kinyanjui DK., Kalani RM., Kinkade C., Muthoka PM., Katz MA., Mott JA. (2014) *A comparison of smartphones to paper-based questionnaires for routine influenza sentinel surveillance, Kenya, 2011–2012*

Onoka K., (2017) *Challenges in Using Mobile Technology for Data Collection in Research Settings* http://www.rroij.com/open-access/challenges-in-using-mobile-technology-for-data-collection-inresearch-settings-.pdf

Pinter, R, Toninelli, D and de Pedraza, P. (2015). *Mobile Research Methods: Possibilities and Issues of a New Promising Way of Conducting Research*. In: Ubiquity Press.

Toninelli, D, Pinter, R & de Pedraza, P. (2015). *Mobile Research Methods: Opportunities and Challenges of Mobile Research Methodologies*, Pp. 1–10. London: Ubiquity Press.

DOI: http://dx.doi.org/10.5334/bar.a. License: CC-BY 4.0.

Porter, K., Nordvik, R., Toolan, F., & Axelsson, S. (2021). Timestamp prefix carving for

filesystem metadata extraction. *Forensic Science International: Digital Investigation*,

38, 301266.

Poynter, R. (2015). *The utilization of mobile technology and approaches in commercial market*

research. Mobile Research Methods, 11

Raghavendra, C. S., Sivalingam, K. M., & Znati, T. (2004). *Wireless sensor networks*. Berlin:

Springer.

Ryder, J., Longstaff, B., Reddy, S., and Estrin, D. (2009). *"Ambulation: a tool for*

monitoring mobility patterns over time using mobile phones," in Proceedings of the 2009

International Conference on Computational Science and Engineering; 2009 Aug 29–31

(Vancouver, BC: IEEE), 927–931. doi: 10.1109/CSE.2009.312

Safaryan, N. (2020). *Methodological issues of education monitoring and evaluation.*

International Journal of Learning and Teaching. 12(4), 176–183.

https://doi.org/10.18844/ijlt.v12i4.4615

Satterlee E., McCullough L., Dawson M., Cheung K. (2015) *PAPER-TO-MOBILE*

DATA COLLECTION: a manual FHI360 https://www.fhi360.org/resource/paper-mobile-

data-collection-manual

Schlee, W., Pryss, R. C., Probst, T., Schobel, J., Bachmeier, A., Reichert, M., et al.

(2016). *Measuring the moment-to-moment variability of tinnitus: the trackyourtinnitus smartphone app.* Front. Ageing Neurosci. 8:294. doi: 10.3389/fnagi.2016.00294

Schobel, J., Pryss, R., Schickler, M., & Reichert, M. (2016). Towards flexible mobile data collection in healthcare. In *2016 IEEE 29th International Symposium on Computer-Based Medical Systems (CBMS)* (pp. 181-182). IEEE.

Scholz, U., Stadler, G., Ochsner, S., Rackow, P., Hornung, R., and Knoll, N. (2016). *Examining the relationship between daily changes in support and smoking around a self-set quit date.* Health Psychol. 35, 514–517. doi: 10.1037/hea0000286

Schuster C., Brito CP., (2011) *Cutting costs, boosting quality and collecting data real-time Lessons from a Cell Phone-Based Beneficiary Survey to Strengthen Guatemala's Conditional Cash Transfer Program*

Stawski, R. S., Sliwinski, M. J., and Hofer, S. M. (2013). *Between-person and within-person associations among processing speed, attention switching, and working memory in younger and older adults.* Exp. Aging. Res. 39, 194–214. doi: 10.1080/0361073X.2013.761556

Stieger, M., Nißen, M., Rüegger, D., Kowatsch, T., Flückiger, C., and Allemand, M. (2018). *PEACH, a smartphone- and conversational agent-based coaching intervention for intentional personality change: study protocol of a randomized, wait-list controlled trial.* BMC Psychol. 6:43. doi: 10.1186/s40359-018-0257-9

Srivastava, L. (2005). Mobile phones and the evolution of social behaviour. *Behaviour & information technology*, *24*(2), 111-129.

Tomlinson, M., Solomon, W., Singh, Y., Doherty, T., Chopra, M., Ijumba, P., ... & Jackson, D.

(2009). The use of mobile phones as a data collection tool: a report from a household

survey in South Africa. *BMC medical informatics and decision making*, *9*(1), 1-8.

Trull, T. J., and Ebner-Priemer, U. (2013). *Ambulatory assessment.* Annu. Rev.

Clin. Psychol. 9, 151–176. doi: 10.1146/annurev-clinpsy-050212-185510

Wilcox, A. B., Gallagher, K. D., Boden-Albala, B., & Bakken, S. R. (2012). Research data

collection methods: from paper to tablet computers. *Medical care*, S68-S73.

White, J., Thompson, C., Turner, H., Dougherty, B., and Schmidt, D. C. (2011).
WreckWatch: *Automatic traffic accident detection and notification with smartphones.*
Mobile Netw. Appl. 16, 285–303. doi: 10.1007/s11036-011-0304-8

World   Bank's   Latin   America   and   Caribbean   Region   (LAC).
http://siteresources.worldbank.org/INTLAC/Resources/257803-
1269390034020/EnBreve_166_Web.pdf

Wrzus, C., and Mehl, M. R. (2015). *Measuring personality processes and their*
social consequences. Eur. J. Pers. 29, 250–271. doi 10.1002/per.1986

Zimmermann, J., Woods, W. C., Ritter, S., Happel, M., Masuhr, O., Jaeger, U., et

al. (2018). *Integrating structure and dynamics in personality assessment: first steps*
toward the development and validation of a personality dynamics Diary. PsyArXiv. doi:
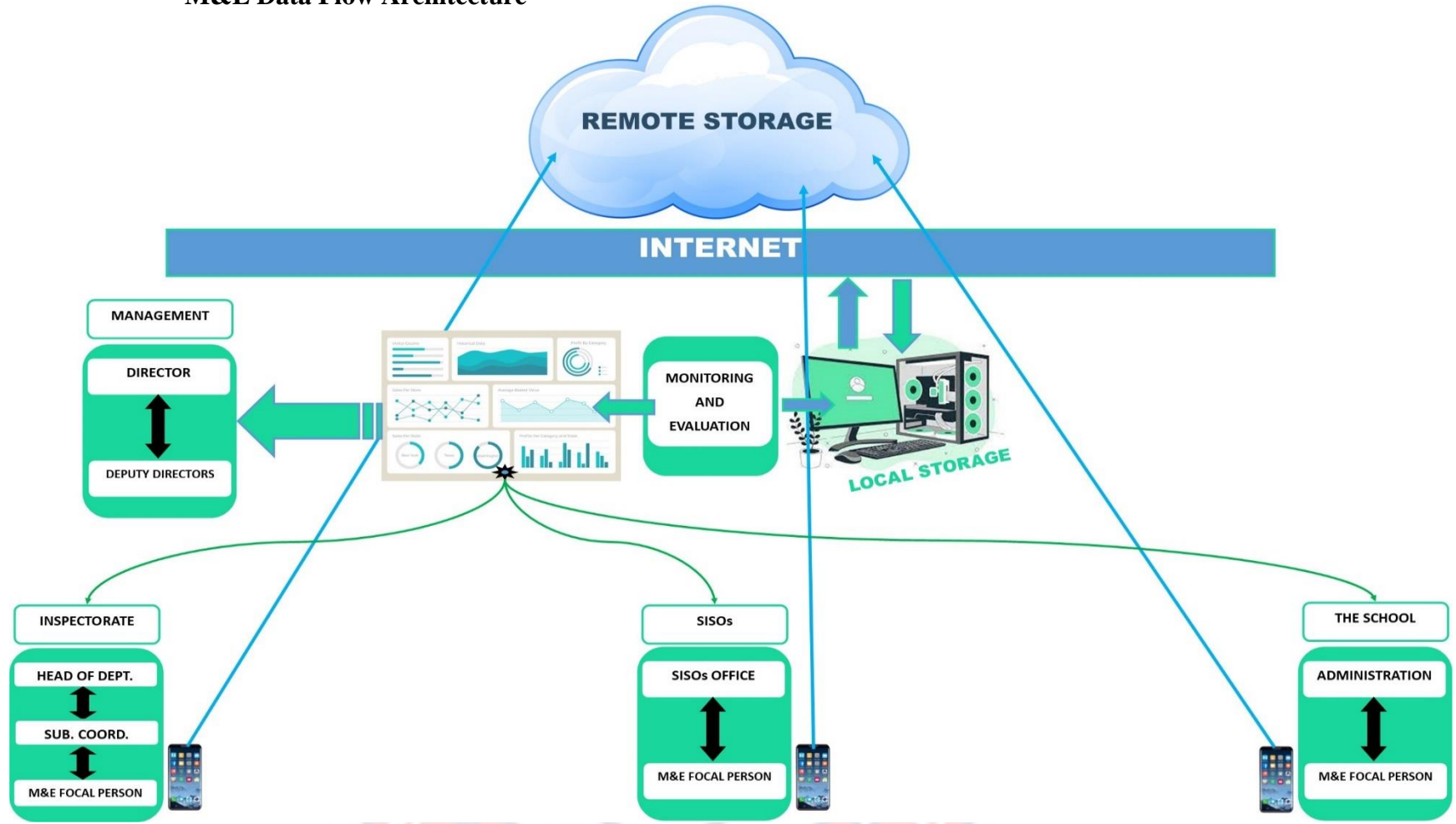10.31234/osf.io/5zcth

https://www.biblegateway.com/passage/?searchLuke%202%3A3-5&version=NIV

https://nama.gov.gh/history-profile/

M&E Data Flow Architecture

Figure 15: A diagram of M&E Data Flow Architecture

APPENDIX A

SAMPLE OF QUESTION

Mobile Data Collection in GES   https://ee.humanitarianresponse.info/x/VTgaJKdF

Mobile Data Collection in GES

Instructions

G.E.S - NSAWAM/ADOAGYIRI MUNICIPAL. (

)

Part 1 - BACKGROUND INFO

Region   *
  ◯ Eastern

District   *
  ◯ Nsawam/Adoagyiri

Gender   *
  ◯ Male
  ◯ Female

Position   *
  ◯ SISO
  ◯ I.T Officer
  ◯ EMIS Officer
  ◯ Headteacher

Number of years in the service   *
  ◯ Less than 1 year
  ◯ 1 to 5 years
  ◯ 6 to 10 years
  ◯ 11 years and above

Part 2 - M&E AND MOBILE DATA COLLECTION SYSTEMS IN GES

1 of 6

Mobile Data Collection in GES   https://ee.humanitarianresponse.info/x/VTgaJKdF

Levels		Yes	No
National	*	○	○
Regional	*	○	○
District	*	○	○

How often do you collect data?

Frequency		Yes	No
Termly	*	○	○
Quarterly	*	○	○
Annually	*	○	○
Once in a while	*	○	○

What type of data is collected?

Type of Data		Yes	No
Enrolment Data	*	○	○
School Profile	*	○	○
Teacher Profile	*	○	○
Staff Movement	*	○	○
Examination Data	*	○	○
Human Resource Data	*	○	○
Financial Data	*	○	○

What were the means of data collection in GES for the last 3 to 5 years?   *

○ Paper-Based

○ Electronic (Mobile Platforms)

○ Excel Template (Softcopy)

○ Word Template (Softcopy)

○ Other

If other, then specify

Were you getting feedback after submitting data?   *

○ Yes

○ No

Which Mobile Data Collection applications does GES use currently?

Mobile Data Collection Applications		Yes	No
Kobo Collect	*	○	○
ODK	*	○	○
Google Forms	*	○	○
Survey CTO	*	○	○
Microsoft Office Forms	*	○	○

Do you get feedback after submitting data?   *

○ Yes

○ No

Comparing the two (2) data collection systems, which one do you prefer?   *

○ Moblie Data Collection

○ Paper-Based and Templates

Please provide a reason for you answer

87

Who collects data in the schools? *

○ Headteacher

○ Assistant Headteacher

○ Curriculum Lead

○ ICT Facilitator

Whom is the data collected submitted to? *

○ Head of Inspectorate

○ SISO

○ EMIS Dirtict Level

○ Regional Office

○ GES HQ

○ MOE EMIS

Part 3 - DATA STORAGE SYSTEM IN GES

How does GES store data collected? *

○ Remote

○ Offline

○ Other

If other, then specify

Is the data accessible at the various levels?

Levels		Yes	No
National	*	○	○
Regional	*	○	○
District	*	○	○
School	*	○	○

Part 4 - STRUCTURE OF DATA COLLECTION SYSTEMS IN GES

88

Levels		Yes	No
National	*	◯	◯
Regional	*	◯	◯
District	*	◯	◯
School	*	◯	◯

*

◯ Yes
◯ No

*

◯ Yes
◯ No

*

◯ Yes
◯ No

*

appointment letters?

◯ Yes
◯ No

*

◯ Yes
◯ No

*

*

89

Mobile Data Collection in GES   https://ee.humanitarianresponse.info/x/VTgaJ

End of Form

you for your time.

90

APPENDIX B

SAMPLE OF RESPONSES DOWNLOADED FROM THE REMOTE SERVER

91

APPENDIX C

SAMPLE OF KOBO TOOLBOX REMOTE SE