FACTORS AFFECTING THE EFFETIVENESS OF WATER, SANITATION, AND HYGIENE (WASH) PRACTICES IN PUBLIC PRIMARY SCHOOLS IN MACHAKOS COUNTY, KENYA

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SHS/MPH/3799-1/2021

A RESEARCH THESIS SUBMITTED TO THE DEPARTMENT OF COMMUNITY HEALTH, SCHOOL OF PUBLIC HEALTH IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER DEGREE IN PUBLIC HEALTH AT AMREF INTERNATIONAL UNIVERSITY

JULY 2025

DECLARATION AND APPROVAL

Declaration by Candidate:

This thesis is entirely my original work and has not been presented for a degree in any other university or any other award.

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DEDICATION

This thesis is dedicated to my family, whose unwavering support and encouragement have been my greatest source of strength.

ACKNOWLEDGMENT

I wish to express my heartfelt gratitude to all those who supported me throughout the course of this study.

First, I am deeply grateful to my supervisors Prof Mohamed Karama and Dr Emmanuel Wamalwa for their guidance, feedback, and encouragement during the research process.

Special thanks to the headteachers, teachers, and pupils of the public primary schools in Machakos County who participated in the study and shared their insights.

I also appreciate the support of my family and friends, whose encouragement kept me going.

Finally, I thank God for the strength and grace to complete this work.

ABSTRACT

Background: Enhancing learning outcomes, lowering absenteeism, and promoting child health all depend on having access to clean water, suitable sanitary infrastructure, and good hand hygiene practices. Even with countrywide initiatives to improve WASH conditions, such as the National School Health Policy, there are still persistent gaps. Less than 40% of rural schools nationwide reliably supply soap and clean water. Semi-arid regions like Mavoko Sub-County are particularly affected by water scarcity, inadequate sanitation, and a lack of hygiene education. The purpose of this study was to evaluate the variables influencing the efficacy of WASH practices in Machakos County's public primary schools. The study aimed to evaluate student hand hygiene practices, analyse individual and socio-behavioural factors influencing WASH practices, evaluate contextual and structural factors associated with hygiene behaviours, and assess the availability, accessibility, and sufficiency of WASH infrastructure.

Methodology: A descriptive cross-sectional design using a mixed-methods approach was adopted. Data were collected from 381 pupils and 9 headteachers sampled across 9 public primary schools. Structured questionnaires, observation checklists, and key informant interviews were used. Quantitative data were analysed using descriptive statistics and chi-square tests, while qualitative data were analysed thematically.

Results: Findings revealed that 52.2% of pupils reported adequate hand hygiene practices, while only 50.9% accessed clean and well-maintained sanitation facilities. Inconsistent water supply and inadequate soap availability were common. Significant associations were found between WASH practices and factors such as gender, age, hygiene knowledge, and the presence of health clubs ($p < 0.05$). Qualitative insights highlighted the importance of teacher involvement, peer role models, and parental support.

Conclusion and Recommendations: The study recommends that the Ministry of Education, school administrators, and development partners increase budget allocations for WASH supplies, strengthen hygiene education programs, improve infrastructure maintenance, and promote community engagement to enhance the effectiveness of school-based WASH practices.

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LIST OF ABBREVIATIONS AND ACRONYMS

COVID-19	Coronavirus Disease 2019
ECD	Early Childhood Development
GoK	Government of Kenya
INEE	Inter-Agency Network for Education in Emergencies
KAP	Knowledge, Attitude, and Practice
MoE	Ministry of Education
MoH	Ministry of Health
NGO	Non-Governmental Organization
SDG	Sustainable Development Goal
SPSS	Statistical Package for the Social Sciences
UN	United Nations
UNICEF	United Nations Children's Fund
WASH	Water, Sanitation, and Hygiene
WHO	World Health Organization

DEFINITION OF TERMS

Adequate WASH Practice: In this study, refers to pupils reporting consistent access to safe water, regular availability of soap, and clean sanitation facilities within their school environment.

Hand Hygiene Practices: Refers to behaviours aimed at maintaining hand cleanliness, including regular washing with soap and water at critical times (e.g., after using the toilet and before eating).

Hygiene: The practices and conditions that help to maintain health and prevent the spread of diseases, such as handwashing with soap and keeping the environment clean.

Improved Sanitation: Facilities that are hygienically separate human excreta from human contact, including flush toilets, ventilated improved pit latrines, and composting toilets (WHO/UNICEF, 2020).

Pit Latrine: A basic type of toilet that collects human waste in a hole in the ground. It may be covered with a slab and enclosed for privacy and hygiene purposes.

Primary School: An institution offering formal education to children typically aged 6–13, from Grade 1 to Grade 8, following early childhood education.

Programs: Structured interventions or sets of coordinated activities designed to improve WASH outcomes in educational institutions**.**

Public Health: The science and art of preventing disease, prolonging life, and promoting health through organized community efforts and informed choices of society, organizations, public and private sectors, and individuals.

Sanitation: The provision of facilities and services for the safe management of human excreta, including the maintenance of hygienic conditions through services such as garbage collection and wastewater disposal.

Sanitation Practices: Daily behaviours and routines related to the use and maintenance of sanitation facilities, such as toilet use, cleaning of toilets, and waste disposal**.**

School Children: Refers to pupils enrolled in primary school, typically between the ages of 6 and 15 years

School Head Teacher: The designated school administrator appointed by the Teachers Service Commission, responsible for overseeing school operations and policy implementation.

WASH: Acronym for Water, Sanitation, and Hygiene; refers to the collective set of practices and infrastructure needed

to ensure clean water access, proper waste disposal, and hygienic behaviours.

WASH Clubs/Health Clubs: School-based student groups focused on promoting hygiene awareness and safe water and sanitation practices.

WASH Infrastructure: Physical facilities and systems installed in schools to support water, sanitation, and hygiene practices (e.g., toilets, water tanks, handwashing stations).

Water: Safe and clean water sourced from treated or uncontaminated supplies, such as piped water, boreholes, protected wells, or rainwater harvesting systems, used for drinking and hygiene purposes in schools.

CHAPTER 1: INTRODUCTION

1.1 Introduction

This section provides the following information: the research's background; a statement of the problem; justification for the research; research objectives; research questions; and importance of the research; scope; delimitation and limitation of the study.

1.2 Background of the Study

Ensuring safe drinking water, functional sanitation, and hygiene opportunities in schools is essential for children's health and education. Globally, 1.7 billion children lack basic WASH services, contributing to preventable diseases that cause the loss of over 443 million school days each year (United Nations Children's Fund & World Health Organization, 2020). In Sub-Saharan Africa, nearly half of schools lack basic water services, and more than half lack adequate sanitation (United Nations Children's Fund & World Health Organization, 2023). These gaps are particularly harmful for girls, who often miss school during menstruation due to inadequate privacy (Sommer et al., 2022).

Kenya's policies, including the National School Health Policy (Ministry of Education [MoE], 2019), highlight multisectoral action to improve WASH. NGOs like UNICEF and WaterAid have supported infrastructure improvements and hygiene education (UNICEF, 2021). Despite these efforts, only about 36–40% of rural schools maintain reliable water and soap access (Omondi et al., 2021). Many still depend on unprotected water sources, heightening health risks (Abok et al., 2022).

In Machakos County, chronic water shortages and poor sanitation infrastructure persist. A 2023 report showed over 70% of schools face frequent water disruptions and overcrowded, poorly maintained toilets. While past research has outlined general WASH conditions, few studies have examined how infrastructural, behavioral, and institutional factors jointly affect WASH effectiveness in semi-arid regions. This study aimed to fill that gap and inform context-specific interventions.

1.3 Problem Statement

Access to adequate water, sanitation, and hygiene (WASH) services is essential for protecting children's health, dignity, and educational success. However, in Machakos County especially in Mavoko Sub-County, the effectiveness of WASH practices remains critically limited, despite existing policies and targeted interventions. Recent data show that more than 70% of public primary schools in the area frequently face water shortages and unreliable supply systems, leaving pupils dependent on rainwater harvesting or bringing water from home (Machakos Department of Health, 2019). In addition, over half of schools' report that their sanitation facilities are overcrowded, poorly maintained, and lack sufficient privacy, disproportionately impacting girls' attendance and participation in class (Sommer et al., 2022).WASH-related illnesses, including diarrhoeal disease, parasitic infections, and respiratory ailments, continue to be common among school-aged children in the county, contributing to absenteeism and diminished academic performance (United Nations Children's Fund & World Health Organization, 2023).County health records have highlighted recurrent diarrhoeal outbreaks linked to unsafe water storage and inadequate handwashing practices (Machakos Health Department, 2019). While infrastructural gaps are well-documented, there is limited understanding of how individual behaviours, cultural

norms, institutional support, and environmental pressures interact to influence the overall effectiveness of WASH initiatives in schools.

Although earlier studies in Kenya have largely examined national-level trends and the general availability of infrastructure (Abok et al., 2021; Omondi et al., 2021). Few have explored how behavioural, contextual, and institutional dynamics combine to shape WASH practices in semi-arid counties like Machakos, where chronic water scarcity, funding limitations, and social factors create unique challenges. This lack of localized evidence constrains policymakers' capacity to design responsive and sustainable interventions.

This study was therefore undertaken to generate context-specific insights into the factors that affect the effectiveness of WASH practices in public primary schools in Machakos County, with the aim of informing practical strategies to improve health and educational outcomes for vulnerable learners.

1.4 Research Questions

i. What is the status of water and sanitation facility availability and adequacy in public primary schools in Machakos County?
ii. What are the prevailing hand hygiene practices among pupils in these schools?
iii. How do individual socio-behavioral factors such as knowledge, attitudes, beliefs, and peer influence affect WASH practices?
iv. What contextual and institutional factors are associated with the effectiveness of WASH practices in public primary schools in Machakos County?

1.5 Main Objective

To assess the factors affecting the effectiveness of water, sanitation, and hygiene (WASH) practices in public primary schools in Machakos County, Kenya.

1.5.1 Specific Objectives

i. To evaluate the availability and adequacy of water and sanitation facilities in public primary schools in Machakos County.
ii. To assess hand hygiene practices among pupils in public primary schools in Machakos County.
iii. To examine individual socio-behavioral factors (knowledge, attitudes, beliefs, and peer influence) influencing WASH practices.
iv. To analyze contextual and institutional factors (access to facilities, environmental conditions, school policies, and resource allocation) associated with WASH practices.

1.6 Justification of the Study

Water, Sanitation, and Hygiene (WASH) practices in schools are essential for safeguarding children's health, dignity, and better educational outcomes. Despite Kenya's National School Health Policy and efforts by development partners, major gaps remain. Fewer than one-third of schools in Kenya meet the minimum standards for safe water and sanitation (Ministry of Education, 2020). These challenges are especially pronounced in semi-arid regions like Machakos, where chronic water scarcity, poor sanitation infrastructure, and limited hygiene promotion hinder effective WASH implementation (Machakos Department of Health, 2019).

Most existing studies have concentrated on infrastructure access, often neglecting how behavioral, institutional, and contextual factors shape WASH practices among pupils. This lack of evidence limits understanding of how knowledge, attitudes, and school support systems interact to influence hygiene behaviors. This study was undertaken to generate context-specific insights into these factors in public primary schools in Machakos County. The findings will inform targeted interventions, guide policy, and support Sustainable Development Goals 3 (Good Health and Well-being) and 6 (Clean Water and Sanitation), ultimately helping stakeholders design practical, sustainable WASH improvements.

1.7 Significance of the Study

The findings of this study will give policymakers, school administrators, and education planners evidence-based insight into how to improve WASH practices, particularly safe water access, appropriate use of sanitation facilities, and student hand hygiene. As they seek to improve school-based WASH programs in line with national development priorities and Sustainable Development Goals (SDGs 3 and 6), the Ministries of Education and Health will find the results useful. NGOs, development partners, and other education stakeholders will also benefit from the study's assistance in creating efficient, situation-specific interventions. This research can help direct better hygiene practices, more efficient use of resources, and the development of healthier school environments by identifying important behavioural, institutional, and infrastructure factors that affect WASH outcomes.

1.8 Scope of the Study

This study was conducted in public primary schools in Machakos County, Kenya. It assessed the factors affecting the effectiveness of water, sanitation, and hygiene (WASH)

practices with a focus on four key dimensions: the availability and accessibility of safe water, the adequacy of sanitation facilities and maintenance routines, hand hygiene behaviors and practices among pupils, and the individual socio-behavioral, contextual, and structural factors that influence WASH practices. Although the study examined WASH infrastructure and resource availability, the emphasis remained on the effectiveness of practices and the institutional and behavioral support mechanisms that sustain hygiene behaviors in school settings. The scope was limited to public primary schools due to the age-specific vulnerabilities of younger learners, who face higher risks of WASH-related diseases and have a greater need for structured hygiene education. As such, the findings may not be generalizable to private institutions or to secondary and tertiary education environments.

1.9 Research Assumptions

This study was conducted under the following assumptions:

1. The pupils and head teachers who participated in the study responded honestly and to the best of their knowledge.
2. The sampled schools were representative of public primary schools in Machakos County.
3. The tools used for data collection (questionnaire, interview guide, and checklist) were understood clearly by the respondents.
4. The environmental conditions during the time of study did not significantly affect the WASH practices being measured.
5. Participants were willing and able to participate without coercion.

CHAPTER 2: LITRATURE REVIEW

2.1 Introduction

This chapter offers an in-depth review of literature examining Water, Sanitation, and Hygiene (WASH) practices within school settings. It begins by defining the key concepts and then critically analyzing findings from global, regional, national, and local studies. The review highlights persistent challenges and identifies evidence gaps that underscore the need for further research. To maintain clarity and align with the study objectives, the discussion is organized into sections covering the availability of safe water, the adequacy of sanitation facilities, hand hygiene behaviors, and the impact of institutional and socio-behavioral factors. Finally, the chapter outlines the theoretical and conceptual frameworks that provide the foundation for this research.

2.2 Conceptualization of Water, Sanitation, And Hygiene (Wash) in Schools

Water, Sanitation, and Hygiene (WASH) refers to the combined provision of safe water, adequate sanitation systems, and hygiene education and practices. In schools, WASH goes beyond simply building infrastructure to also include efforts that encourage positive behaviour and promote health. According to the World Health Organization (WHO, 2021), effective school WASH entails reliable access to clean drinking water, separate and hygienic toilets for boys and girls, functional handwashing stations equipped with soap, and hygiene education integrated into everyday school activities. This comprehensive approach helps create learning environments that support children's health and dignity (Cronk et al., 2021).

The critical role of WASH has been underscored in international frameworks such as Sustainable Development Goal 6, which aims to achieve universal access to safe water and sanitation by 2030 (United Nations Children's Fund & World Health Organization, 2023). Despite these commitments, turning policies into consistent, effective practices continues to pose challenges both globally and within local contexts.

2.3 Global Perspective on School Wash Practices

Globally, more than 1.7 billion children still do not have access to basic WASH services, which contributes substantially to preventable diseases (United Nations Children's Fund & World Health Organization, 2023). Evidence shows that poor sanitation alone causes an estimated 297,000 deaths each year among children under five due to diarrheal illnesses (United Nations Children's Fund & World Health Organization, 2020). In school settings, the lack of adequate WASH facilities not only drives the spread of infections but also contributes to absenteeism, poorer academic performance, and increased dropout rates; challenges that disproportionately affect girls (Wolf et al., 2019). Research by Vivas et al. (2020) indicates that combining hygiene education with improved infrastructure significantly boosts handwashing practices and helps lower infection rates. However, insufficient funding, weak monitoring systems, and limited community involvement often prevent these gains from being sustained over time. A multi-country study by Garn et al. (2020) similarly found that many schools depend heavily on donor-funded programs, which frequently end without plans or resources to maintain WASH facilities.

These insights underscore that enhancing WASH effectiveness requires both investments in infrastructure and long-term efforts to change behaviour. Although progress has been made in documenting the impact of inadequate WASH globally, there is still no consensus

on the most effective ways to sustain improvements. For instance, Vivas et al. (2020) report that integrating hygiene education and facility upgrades can cut infection rates by up to half. Yet, Garn et al. (2020) warn that such benefits often fade once external funding is withdrawn. This highlights the reality that infrastructure alone is not enough without strong institutional support and active community participation. Other scholars, such as Wolf et al. (2019), have also pointed out that global monitoring systems often overlook barriers like cultural taboos around menstruation or stigma attached to using sanitation facilities, showing the importance of designing more context-specific solutions.

2.4 Regional Evidence from Sub-Saharan Africa

Across Sub-Saharan Africa, efforts to improve WASH conditions in schools have not been consistent. United Nations Children's Fund and World Health Organization (2023) report that less than 55% of schools in the region have access to even the most basic hygiene services. Challenges such as limited supplies of soap and water, overcrowded and poorly maintained latrines, and inconsistent facility upkeep remain widespread (Ngcongo & Tekere, 2023).

An example, Tanzanian research revealed that while about 75% of schools had latrines, only 22% could ensure adequate cleanliness and privacy for pupils (Cronk et al., 2021). Similarly, a Ugandan study by Ngcongo and Tekere (2023) found that shortcomings in WASH infrastructure, coupled with limited teacher training, contributed to poor hygiene practices among learners. These findings emphasize that any intervention must consider the cultural, financial, and policy environment of each setting. Socioeconomic inequalities also deepen disparities in WASH access, leaving rural and marginalized communities at a significant disadvantage (Garn et al., 2020). This regional evidence underscores the

importance of linking WASH improvements with broader strategies in education and poverty reduction.

However, results from different studies do not always align. For example, Cronk et al. (2021) found that although building more facilities in Tanzanian schools improved access, it did not significantly change how students practiced hygiene. By contrast, Ngcongo and Tekere (2023) observed some positive behaviour change when hygiene promotion was integrated into daily school routines through health clubs and teacher-led activities. These contrasting results suggest that building infrastructure alone is insufficient; effective programs also require context-specific strategies to encourage sustained behaviour change. In addition, the persistent gap between urban and rural schools, along with the influence of poverty on long-term WASH practices, remains underexplored in many Sub-Saharan African countries.

2.5 National Perspective in Kenya

Kenya has made WASH a national priority through its National School Health Policy (MoE, 2019), which requires all public schools to provide safe water, clean toilets, and hygiene education. Despite these commitments, implementation has fallen short. A national survey by the Ministry of Education (2020) showed that fewer than one-third of schools meet the minimum WASH standards.

Research by Omondi et al. (2021) reported that only 36% of rural schools had reliable access to clean water and soap. Similarly, Abok et al. (2021) found that fewer than half of schools regularly held hygiene education sessions. United Nations Children's Fund and

World Health Organization (2023) further highlighted that gaps in monitoring, funding, and teacher training continue to slow progress.

Other studies point out that although infrastructure investments have increased, they are often not linked to behavior change programs, reducing their long-term impact (Garn et al., 2020).

Kenyan research also presents mixed views about the effectiveness of school health policies. While Omondi et al. (2021) underscore the positive role of the National School Health Policy in raising awareness, Abok et al. (2021) argues that weak teacher training and limited funding undermine consistent implementation. These different findings highlight the need for more research to understand how national policies can be turned into practical improvements, especially in under-resourced areas like Machakos County.

2.6 Local Context: Wash in Machakos County

Machakos County faces serious WASH challenges made worse by its dry climate, frequent water shortages, and limited school budgets. According to a county report, more than 70% of schools regularly run out of water, interrupting hygiene practices and forcing students to depend on unsafe water sources. In addition, more than 60% of schools lack regular toilet cleaning and proper waste management (Machakos County Health Department, 2019). Inadequate sanitation infrastructure results in crowded latrines, lack of privacy, and higher absenteeism, especially among girls during menstruation (Sommer et al., 2022). Local studies have also shown that cultural beliefs, low parental involvement, and limited teacher training further weaken WASH efforts (Ngcongo & Tekere, 2023).

Although the county health department identifies persistent water scarcity as the main barrier, some schools have tried creative solutions such as rainwater harvesting and community-funded water trucking. However, there is little evidence on whether these measures are sustainable or scalable over time. While many reports have documented gaps in infrastructure, fewer studies have explored how cultural attitudes, teacher capacity, and budget constraints together shape hygiene practices among students. Addressing this gap is essential for designing effective, context-appropriate interventions. This study focuses on Machakos as a setting where infrastructure, behaviour, and context intersect to limit the success of school WASH programs.

2.7 Availability of Safe Water

Reliable access to clean water is essential for successful WASH programs. Around the world, schools without reliable water sources see higher rates of diarrheal illness and increased absenteeism (Freeman et al., 2020). In Kenya, data from the Ministry of Education (2020) show that 64% of rural schools lack dependable piped water, leaving pupils to fetch water from streams or depend on rainwater collection. In Machakos County, these problems are made worse by chronic water shortages. Abok et al. (2021) found that schools with piped water were 60% more likely to maintain good handwashing routines. Yet research indicates that water access alone is not enough without hygiene education and working infrastructure (Garn et al., 2020). For example, Garn et al. (2020) observed that even when schools had reliable water systems, some pupils still avoided using designated water points due to cultural habits or perceived inconvenience. These findings underscore the need to address behavioral factors alongside infrastructure.

Additionally, there is limited evidence on how school leadership and parental involvement influence the long-term management of water supply systems.

2.8 Soap Availability and Hand Hygiene Behaviour

Hand hygiene is recognized as one of the most effective ways to prevent disease, yet fewer than 10% of schools across Sub-Saharan Africa have a steady supply of soap (United Nations Children's Fund & World Health Organization, 2023). Curtis et al. (2022) observed a strong link between the availability of soap and pupils' handwashing behaviour. In Machakos, teachers reported that theft and inconsistent funding often disrupted soap provision (Ngcongo & Tekere, 2023).

Behavioural research highlights the importance of reminders and role modelling. For example, Curtis et al. (2022) showed that when teachers led demonstrations and displayed visible cues, handwashing compliance improved by up to 40%. Other studies have revealed a persistent gap between knowledge and practice. Although many pupils understood why handwashing matters, Curtis et al. (2022) found actual handwashing rates remained low when soap was lacking or teachers did not demonstrate the behaviour themselves. These findings point to the need for combining infrastructure with active supervision and culturally relevant hygiene messages to encourage lasting habits.

2.9 Sanitation Facilities and Gender Disparities

Adequate, private, and well-maintained sanitation facilities are essential for keeping children in school, particularly girls (Sommer et al., 2022). In Machakos County, many toilets lack doors, running water, or menstrual hygiene supplies, creating discomfort and contributing to absenteeism (Machakos County Health Department, 2019).

Globally, Sommer et al. (2022) found that when toilets lack privacy, adolescent girls are 45% less likely to use them. This highlights the importance of gender-sensitive WASH interventions, including separate facilities and access to menstrual hygiene products (United Nations Children's Fund & World Health Organization, 2023). While Sommer et al. (2022) provides strong evidence that better sanitation facilities can improve attendance, Ngcongo and Tekere (2023) note that cultural taboos surrounding menstruation often remain even when infrastructure improves. This gap highlights the importance of approaches that tackle both infrastructure challenges and the cultural attitudes that limit effective use.

2.10 Institutional and Behavioural Factors

Institutional support and consistent behavioral reinforcement are critical for sustaining effective WASH practices. Biran et al. (2020) reported that schools embedding hygiene education into their curriculum achieved 30–40% higher handwashing compliance compared to those without such integration. Despite this evidence, many schools still lack structured programs and sufficient teacher training (Omondi et al., 2021). Ngcongo and Tekere (2023) further demonstrated that student health clubs and peer-led activities can increase ownership and promote long-term behavior change. Nonetheless, limited funding and competing priorities frequently constrain their implementation. Biran et al. (2020) also noted that standalone health clubs often have minimal impact when not supported by broader school policies, budget commitments, and clear accountability for teachers. This underscores a persistent gap in understanding how institutional frameworks can be strengthened to sustain WASH improvements over time. Moreover,

little is known about how parental involvement interacts with school initiatives to reinforce hygiene practices at home.

2.11 Identified Knowledge Gaps

While research has documented WASH infrastructure and practices in Kenyan schools, important gaps remain:

1. Few studies have examined how infrastructure, behaviour, and institutional factors jointly shape sustained WASH outcomes.
2. Limited evidence exists on how teacher attitudes, peer norms, and parental engagement influence hygiene practices in semi-arid areas like Machakos.
3. The impact of resource constraints and cultural beliefs on gender disparities in sanitation and menstrual hygiene remains underexplored.
4. Findings on the effectiveness of school health clubs are mixed, highlighting a need to assess contextual factors such as funding, teacher training, and community support.
5. Although national policies are well described, their implementation challenges at the local level are poorly understood.

This study aims to fill these gaps through a mixed-methods approach that can inform targeted, sustainable interventions.

2.12 Theoretical Framework

This study is guided by the BASNEF Model (Beliefs, Attitudes, Subjective Norms, and Enabling Factors) developed by Hubley (1993). The BASNEF model offers a structured way to understand the factors that shape health-related behaviours, especially in contexts where behaviour change is vital for preventing disease and promoting health. According to this model, four main elements influence practices such as handwashing and proper sanitation:

1. **Beliefs**: What students know or believe about hygiene and its role in preventing illness.
2. **Attitudes**: How students feel about engaging in hygiene practices, including whether they view them positively or negatively.
3. **Subjective Norms**: The social expectations and pressures from peers, teachers, or school leaders that shape individual hygiene behaviours.
4. **Enabling Factors**: The practical resources, time, infrastructure, and skills that make these behaviours possible such as having soap, water, and clean toilets available.

Students' hygiene practices are shaped by both their knowledge and the social and environmental cues around them. The BASNEF model highlights that behavior change relies on beliefs, social norms, and access to resources. In WASH contexts, this means that infrastructure alone is not enough; positive attitudes, peer support, and consistent availability of materials like soap are also critical. The model guided this study by examining how individual and institutional factors together influence hygiene behaviors

2.13 Conceptual Framework

The conceptual framework guiding this study shows how individual, institutional, contextual, and structural factors interact to shape the effectiveness of Water, Sanitation, and Hygiene (WASH) practices in public primary schools. Appropriate WASH practices are defined as regular access to safe drinking water, use of adequate and clean sanitation facilities, and consistent handwashing with soap.

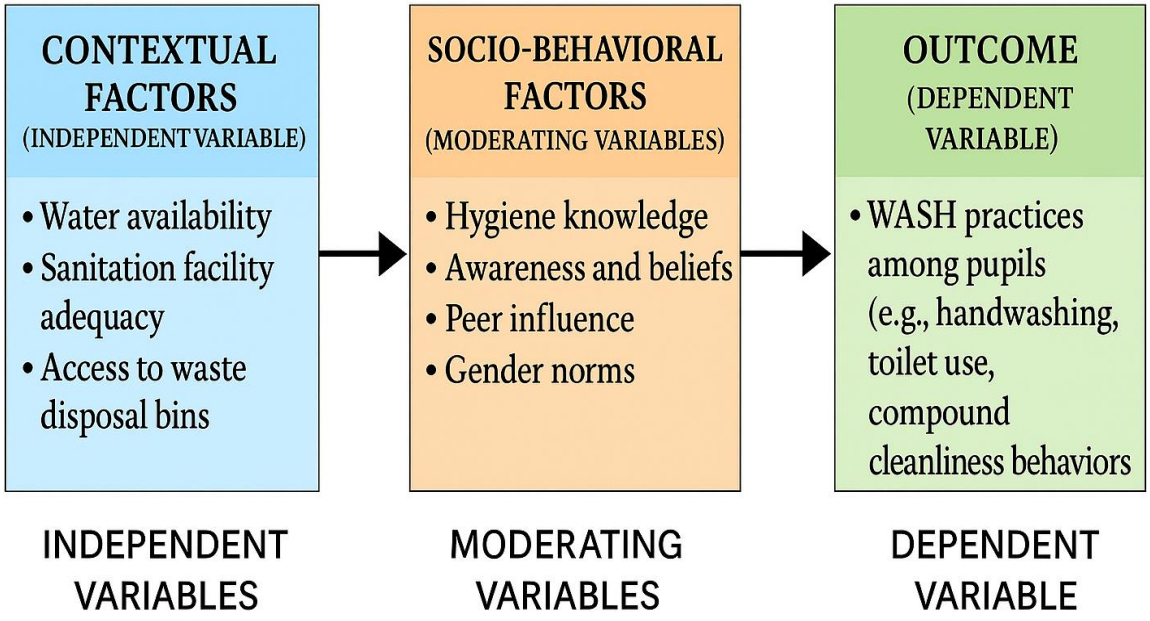
The framework illustrates that pupils' hygiene behaviours, such as handwashing and proper toilet use (dependent variable), are directly influenced by independent variables including the availability of safe water, soap, functional sanitation infrastructure, and waste disposal systems.

These relationships are further shaped by moderating factors that can strengthen or weaken the link between infrastructure and behaviour. They include individual socio-behavioural elements like pupils' knowledge, attitudes, beliefs, and peer influence, along with contextual and structural factors such as school WASH policies, teacher involvement, funding, and the broader environment. Together, these elements enable or hinder the adoption of appropriate hygiene practices.

The framework provides a clear basis for examining how behavioural, environmental, and institutional drivers affect hygiene standards in schools and helps identify entry points for interventions aimed at improving WASH practices in Machakos County's public primary schools. Constructs are clearly defined: appropriate practices are operationalized as regular handwashing with soap, use of sanitation facilities, and access to safe water. By focusing

on the most relevant socio-behavioural and contextual factors, the framework ensures alignment with the study objectives and guides data collection and analysis.

Figure 2.1: Conceptual Framework



CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter presents the methodology used to investigate the factors influencing the effectiveness of Water, Sanitation, and Hygiene (WASH) practices in public primary schools in Machakos County, Kenya. It outlines the research design, study variables, study area, target population, sampling procedures, data collection tools, data analysis techniques, and ethical considerations. The approach integrated both quantitative and qualitative methods to provide a comprehensive understanding of WASH practices and their determinants.

3.2 Research Design

This study used a descriptive cross-sectional design with a mixed-methods approach. Quantitative data was collected through structured questionnaires to measure WASH practices, while qualitative insights came from in-depth interviews, observations, and a focus group discussion. This design was chosen because it allowed the researcher to assess the status and associated factors of WASH practices at one point in time without manipulating variables. A cross-sectional approach was suitable for exploring relationships between factors such as knowledge, facility availability, and hygiene behaviors (Mugenda, 2003). By combining descriptive and analytical methods, the study could both describe how common various WASH practices were and examine their associations with socio-demographic, institutional, and environmental variables through cross-tabulations and chi-square tests.

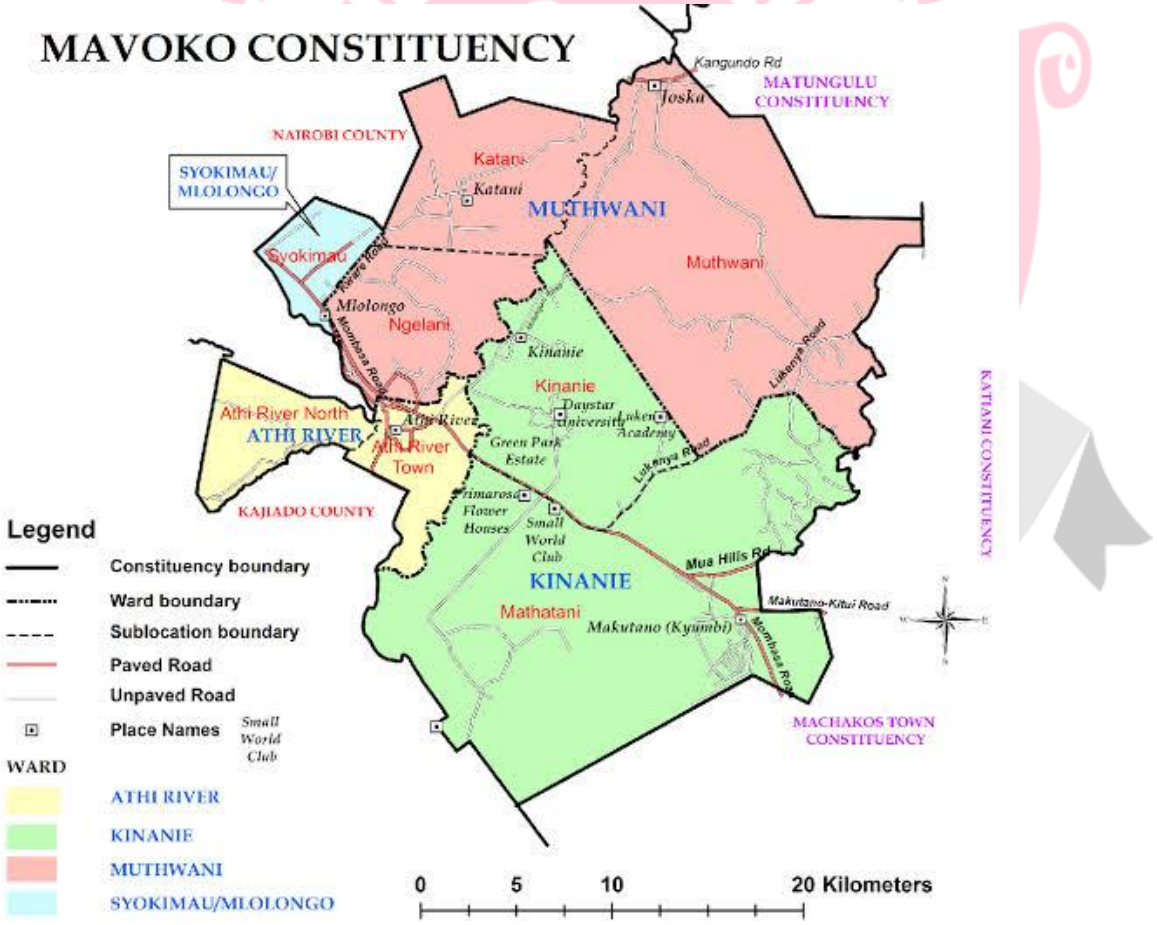
The descriptive cross-sectional design also allowed data to be collected efficiently within limited time and resources, making it practical for a study covering multiple schools in Mavoko Sub-County. Kothari (1990) notes that this approach suits public health research in resource-limited settings because it enables structured data collection with manageable sample sizes while producing evidence to inform policy and interventions. Combining quantitative and qualitative methods improved the validity of the findings through triangulation. Quantitative data yielded measurable indicators, such as the proportion of pupils practicing handwashing, while qualitative data provided deeper insights into perceptions, barriers, and institutional challenges. Overall, this design was chosen because it was comprehensive, cost-effective, and suitable for describing current practices and exploring factors influencing WASH effectiveness in public primary schools in Machakos County.

3.3 Study Location

The study was conducted in Machakos County, located in Kenya's eastern region, with Machakos town serving as the administrative headquarters. According to the 2019 Kenya Population and Housing Census, as reported in the 2023 Machakos County Analytical Report by the Kenya National Bureau of Statistics, the county had a population of 1,421,932 and spans approximately 6,043 km^2. The terrain is hilly, and the climate is generally semi-arid. Machakos County is divided into eight sub-counties: Machakos, Mavoko (Athi River), Mwala, Matungulu, Masinga, Kangundo, Kathiani, and Yatta (KNBS, 2019). This study focused on Mavoko Sub-County, one of the most urbanized and rapidly growing regions within the county.

Mavoko Sub-County is subdivided into five educational zones: Syokimau, Muthwani, Kinanie, Athi River, and Mlolongo. These zones were selected based on reports of recurrent water shortages and increased incidence of waterborne diseases among school children, conditions attributed to poor WASH practices (Machakos County Health Department, 2019). The sub-county's semi-arid setting further compounds water accessibility challenges, especially in public primary schools during dry seasons.

Figure 3.1: Geographic layout of Mavoko Sub-County with the five educational zones examined in this study



Source from Mavoko Constituency Website

3.4 Target Population

A total of 82 public primary schools in Mavoko Sub-County formed the sampling frame for this study. Primary school students face more significant health vulnerabilities than those in higher levels of education, partly due to limited capacity to manage personal hygiene and the frequent neglect of their WASH-related needs by school authorities.

The study targeted both school head teachers and pupils in Grades 6, 7, and 8. Head teachers were included as key informants due to their role in managing school infrastructure, overseeing WASH programs, and maintaining records on pupil enrolment, sanitation facilities, and school performance. Pupils were selected as the primary respondents to capture first-hand information on WASH practices. The target population consisted of 6,724 pupils across the three upper primary grades, comprising 3,483 boys and 3,241 girls.

Table 3.1 Population Targeted for Study

Sub-county	Zones	No of schools	No of pupils in grades six and seven
Mavoko	Syokimau	19	1783
	Muthwani	13	1233
	Kinanie	11	957
	Athi river	21	1423
	Mlolongo	18	1328
Total	5	82	6724

Source: Sub- County Education Office, Mavoko Sub- County 2022

3.5 Sample Size and Sampling Procedures

The practice of choosing representatives of a group to reflect the overall population is known as sampling (Babbie & Maxfield, 1995). Strydom and Venter (2002) describe a sample as "*the process of picking a subset of a population or universe and deciding whether that subset is illustrative of that populace or universe*." Mugenda and Mugenda (2003) define sampling as "*the development of selecting a subject from a set of belongings in order to draw assumptions about the entire set*." In this study, a multi-stage sampling approach was used to ensure representation across the five educational zones of Mavoko Sub-County. First, stratified sampling was applied by categorizing all 82 public primary schools according to the zones of Syokimau, Muthwani, Kinanie, Athi River, and Mlolongo. This step ensured that schools from all geographical contexts were proportionately included. Next, simple random sampling was employed to select 9 schools from the strata, representing approximately 10% of all public primary schools in the sub-county. Each school was assigned a unique code on identical pieces of paper, thoroughly mixed in a container, and drawn without replacement to give each school an equal chance of being selected.

Within each selected school, systematic random sampling was used to select pupil respondents. The class registers of Grades 6, 7, and 8 served as the sampling frames. The sampling interval (k) was calculated by dividing the total number of eligible pupils by the number allocated for each school based on proportionate allocation. A random starting point within the interval was selected, and every k-th pupil was included in the study.

Additionally, purposive sampling was applied to identify headteachers for key informant interviews, given their role in overseeing WASH implementation and their rich knowledge of school operations. Two focus group discussions (FGD) were conducted in Kinanie and Athi-river Zone to gather collective insights from teachers and health club patrons, selected based on their experience in promoting hygiene practices.

This combination of stratified, simple random, systematic, and purposive sampling techniques ensured broad representation and minimized selection bias, thereby enhancing the validity and generalizability of the study findings.

3.5.1 Sample Size Determination

This study involved three levels of sampling: schools, school heads, and pupils. According to Mugenda and Mugenda (1999), for descriptive studies, a minimum of 10% of the accessible population is acceptable. Based on this guidance, 9 out of 82 public primary schools in Mavoko Sub-County were selected through simple random sampling. To estimate the required sample size, the study applied the Fisher et al. (1998) formula, incorporating a WASH-specific prevalence rather than the default 50% to improve precision. According to Omondi et al. (2021), approximately 36% of schools in comparable rural Kenyan settings had adequate WASH practices, implying that 64% did not adopt recommended practices. Therefore, the proportion (p) was set at 0.64.

The formula applied was:

$$n = \frac{(Z^2 \times p \times q)}{d^2}$$

Where:

n = desired sample size

Z = standard normal deviate at 95% confidence level (1.96)

p = estimated proportion of the population with the attribute (0.64)

q = 1 - p (0.64)

d = margin of error (0.05)

Calculation:

$$n = \frac{1.96^2 x\ 0.5\ x\ 0.5}{0.05^2} = \frac{(3.8416\ x\ 0.2304)}{0.0025} = \frac{0.8851}{0.0025} = 355$$

Finite Population Correction (When Population < 10,000):

$$n_f = \frac{n}{(1+{}^{n}/_{N})}$$

Where:

n_f = adjusted sample size

n = initial sample size (355)

N = total population (6,724)

Calculation:

$$n_f = \frac{355}{(1+\left(\frac{355}{6724}\right))} = \frac{355}{1.0528} \approx 337$$

Therefore, the adjusted sample size was 337.

However, to improve accuracy and cater for any pupils who might not respond, a total of 381 pupils were sampled proportionally from the nine selected schools using stratified random sampling. This bigger sample helped make the results more reliable.

3.5.2 Sample Selection Procedure

This study adopted a multi-stage sampling strategy to obtain a representative and reliable sample reflective of WASH practices across the study area. Initially, all 82 public primary schools in Mavoko Sub-County were stratified into five educational zones (Syokimau, Muthwani, Kinanie, Athi River, and Mlolongo) to account for geographical and contextual diversity in water and sanitation access.

From these strata, 9 schools were randomly selected, representing approximately 10% of the school population, to ensure proportional inclusion. Simple random sampling was implemented by assigning identification codes to each school, mixing them thoroughly, and drawing them without replacement to eliminate bias.

Pupil respondents were then identified through systematic random sampling. Each school's class registers for Grades 6, 7, and 8 served as sampling frames. A sampling interval was computed by dividing the number of eligible pupils by the sample size allocated to the school. A random starting point within the interval was selected to determine where to begin listing respondents, after which every k-th pupil was included.

The final sample size of 381 pupils accounted for potential non-response and improved statistical precision beyond the minimum calculated sample of 337. In addition to pupil

surveys**,** 9 headteachers were purposively sampled for in-depth interviews, providing institutional perspectives on WASH implementation and policy.

Furthermore, a focus group discussion was conducted in Kinanie Zone and Athi river zone, targeting teachers and health club patrons who play a role in shaping hygiene norms. This multi-layered approach ensured that the study captured diverse insights across different stakeholders and school environments.

3.5.3 Inclusion and Exclusion Criteria

Inclusion Criteria: Pupils must be enrolled in grades 6, 7, or 8 in one of the selected public primary schools within Mavoko Sub-County. Pupils must be willing to participate in the study and have returned signed parental/guardian consent and personal assent forms. Pupils must have been present during the data collection period.

Exclusion Criteria: Pupils who are absent during the data collection period.Pupils in grades lower than 6 or not currently enrolled in the selected schools.Pupils whose parents/guardians did not provide written consent, or who themselves did not assent to participate.

Table 3.2: Sample Matrix

	Target population	Sample size
Schools	82	9
Pupils	6830	381

The indicative proportionate allocation was placed at 5.3% per school which gave the sample size per school to fit the total sample size requirement as shown in Table 3.3 below

Table 3.3: Indicative Proportionate allocation of sample per school

PRIMARY SCHOOL	TOTAL POPULATION	PROPORTION (%)	SAMPLE SIZE
S1	833	5.30%	47
S2	1421	5.30%	78
S3	757	5.30%	44
S4	910	5.30%	52
S5	422	5.30%	24
S6	564	5.30%	31
S7	533	5.30%	30
S8	620	5.30%	34
S9	770	5.30%	41
TOTAL	6830		381

3.6 Data Collection Tools

A multi-method approach was employed to enhance the credibility and richness of the findings through methodological triangulation. This approach involved collecting both primary and secondary data using four complementary tools: semi-structured questionnaires, focus group discussions (FGDs), in-depth interviews, and structured observations.

3.6.1 Primary and Secondary Data

Secondary data were gathered through desk reviews of official policy documents, health records, and prior WASH assessments, which provided contextual and historical perspectives on sanitation and hygiene challenges in Machakos County. Sources included reports from the Ministry of Education, Machakos Department of Health, and development partners such as UNICEF and World Vision. Primary data were collected through the following methods:

(a) Questionnaire Survey

Semi-structured questionnaires were administered to pupils in Grades 6–8 to collect quantitative data on personal hygiene practices, knowledge of WASH concepts, availability of facilities, and participation in school health initiatives. The questionnaires included both closed- and open-ended questions and were pre-tested prior to the main data collection. Responses were captured digitally using the Kobo Collect mobile application, which enhanced accuracy, minimized data entry errors, and ensured secure storage of records.

(b) Focus Group Discussions (FGDS)

Two FGDs were conducted in different educational zones Kinanie and Athi River to gather qualitative insights from teachers, health club patrons, and pupil representatives. Each discussion comprised 7–10 participants and was facilitated by two trained research assistants: a moderator, who guided the conversation using a structured discussion guide, and a note-taker, who documented the proceedings. FGDs explored perceptions of hygiene

promotion strategies, barriers to WASH compliance, and suggestions for improvement. With participants' consent, all discussions were audio-recorded to ensure fidelity and completeness of information.

(c) In-Depth Interviews

In-depth interviews were conducted with key informants considered central to WASH management at the school level. These included the County Education Officer and headteachers of the selected schools. The interviews focused on resource allocation, policy enforcement, institutional challenges, and opportunities for strengthening WASH interventions. Interview guides were developed to ensure consistent coverage of relevant themes across respondents.

(d) Observation

A structured observation checklist was used to assess the physical conditions of WASH facilities in the sampled schools. Observations focused on the availability and functionality of water points, the cleanliness and privacy of toilets, the presence and placement of handwashing stations, and the existence of waste disposal bins. These observations provided objective evidence to corroborate or contrast with self-reported data from pupils and staff conditions in the schools.

3.7 Validity of Instruments

The validity of a research instrument refers to how well it measures what it is intended to measure (Mugenda & Mugenda, 2003). To ensure content validity, the questionnaires, interview guides, and observation checklists were first reviewed by the academic supervisor, who provided feedback on clarity, coverage of relevant domains, and

appropriateness for the study objectives. Revisions were made accordingly to address issues such as ambiguous wording and incomplete coverage of the constructs outlined in the conceptual framework.

Further validation was conducted through expert review by two independent public health professionals experienced in WASH assessments. Their recommendations informed the refinement of the tools to align with current WASH guidelines and improve relevance to the local school context.

A pretest was conducted in one public primary school in Mavoko Sub-County that was not part of the main study sample. During pretesting, 10 pupils and 1 headteacher participated in filling the questionnaires and responding to the interview guide. The pretest aimed to check clarity, flow, timing, and comprehension of the instruments. Based on this exercise, minor revisions were made, including simplifying complex terms and adjusting response options to ensure all questions were understandable to pupils in upper primary classes.

Triangulation strategies were also applied by using multiple data collection methods; questionnaires, focus group discussions, in-depth interviews, and observation checklists to validate information across sources.

3.7.1 Reliability of Instruments

Reliability refers to the consistency and stability of the measurement over time (Mugenda & Mugenda, 2003). To enhance reliability, the questionnaires were pilot tested in the pretest school, and results were assessed for internal consistency. Feedback from pretest participants confirmed that questions produced similar responses across comparable situations, demonstrating acceptable reliability.

Furthermore, structured training sessions were conducted with the three research assistants to standardize data collection procedures and minimize interviewer bias. The use of the Kobo Collect application also supported consistent electronic data entry and reduced manual errors.

3.8 Data Collection Procedures

Data collection was implemented in phases. First, the researcher obtained an introductory letter from AMREF International University, which was presented to the Machakos County Director of Education. The County Director issued an official authorization letter addressed to all public primary school headteachers in Mavoko Sub-County.

Advance visits and phone calls were made to each selected school to schedule suitable data collection dates and explain the study objectives. On the agreed days, pupils were gathered and informed about the purpose of the study, assured of confidentiality, and asked for their assent if parental consent had been provided. Questionnaires were then administered in classroom settings under supervision, with each participant completing their form independently.

For qualitative data, in-depth interviews were held in private offices within the schools. Focus group discussions were conducted in two schools located in Kinanie and Athi River zones, each involving 8–10 pupils. Observation checklists were completed by walking through the school compound and sanitary facilities. At the end of each day, data were reviewed for completeness and uploaded securely.

3.9 Data Analysis Techniques

According to Kothari (2004), data analysis involves calculating measures and identifying patterns or relationships within data. Singh (2006) describes it as examining and breaking down information into smaller parts, synthesizing results, and reorganizing them for clearer interpretation. Similarly, Bogdan and Biklen (1992) define analysis as a systematic process of finding patterns and arranging data in a way that communicates the findings effectively.

Quantitative data collected through questionnaires were coded and entered SPSS Version 21.0. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize the variables. Cross-tabulations helped explore how variables were distributed across different categories. Inferential statistical tests, primarily Chi-square analyses, were conducted to assess the associations between independent variables (e.g., gender, age, hygiene knowledge, presence of health clubs) and dependent variables (WASH practices) at a 95% confidence level ($p < 0.05$). This helped to establish the statistical significance and strength of observed relationships. Correlation analysis was also performed to explore the degree of association between selected continuous or ordinal variables.

Qualitative data from interviews, focus group discussions, and observations were transcribed verbatim and reviewed repeatedly to achieve familiarity. Thematic analysis was conducted manually, involving open coding to identify recurring ideas, grouping related codes into categories, and then deriving overarching themes that reflected patterns in participants' experiences and perspectives. This process was guided by the study objectives and conceptual framework to ensure alignment with the research questions.

Triangulation of findings from the different data sources enhanced the validity of interpretations by comparing and cross-verifying information from quantitative and qualitative strands. The integrated analysis provided a richer, contextualized understanding of the factors influencing the effectiveness of WASH practices in public primary schools in Machakos County.

3.10 Ethical Considerations

The researcher obtained multiple layers of authorization and ethical clearance before commencing data collection. Initial approval to conduct the study within Machakos County was granted by the Ministry of Education Headquarters, which issued a formal letter permitting the research within public primary schools. This approval was then presented to the Machakos County Director of Education, who endorsed the study and provided further clearance to engage schools within the county. Subsequently, the researcher sought permission from the Sub-County Director of Education (SCDE) for Mavoko Sub-County, who issued an official introduction letter addressed to head teachers at the selected public primary schools. This letter facilitated cooperation and allowed the researcher to access the schools and interact with pupils and staff.

Ethical clearance was obtained from the AMREF Health Africa Ethics and Scientific Review Committee (ESRC) to ensure compliance with established protocols for protecting human subjects. A research license was also granted by the National Commission for Science, Technology and Innovation (NACOSTI).

Prior to data collection, all prospective participants were thoroughly briefed about the study's objectives, procedures, and their rights, including voluntary participation and the

freedom to withdraw at any stage without any repercussions. Confidentiality was assured, with all data anonymized and stored securely.

For pupils under 18 years, informed consent was obtained from parents or guardians through signed forms, which were returned to the schools. Only those pupils whose guardians consented were approached for assent, which was documented in writing. To further protect participant privacy, respondents were instructed not to include any personal identifiers on questionnaires. Completed tools were securely stored with access restricted to the researcher and supervisory team.

Prior to fieldwork, the researcher contacted each head teacher by phone to confirm appointments and schedule data collection at times that would minimize disruption. Throughout the study, the researcher adhered to the principles of beneficence, respect, and justice, following all institutional and national ethical guidelines to safeguard the dignity and welfare of participants.

CHAPTER 4: RESULTS

4.1 Chapter Overview

This chapter presents the study findings structured around the research objectives:

1. To assess the availability and effectiveness of safe water provision.
2. To evaluate the adequacy and effectiveness of sanitation facilities.
3. To determine the effectiveness of hand hygiene practices.
4. To examine the institutional and socio-behavioural factors influencing the effectiveness of WASH practices.

Results are organized by each objective, combining descriptive statistics and qualitative themes. Where relevant, tables and figures are included to enhance clarity. The criteria used to define adequate or inadequate effective WASH practices are also detailed to ensure transparency of categorization

4.2 Introduction

This chapter provides a comprehensive analysis, presentation, and interpretation of data collected from various stakeholders in Mavoko Sub-County, Machakos County. The data focus on factors influencing the effectiveness of water, sanitation infrastructure, and hygiene practices in public primary schools. Analysis is organized by research objectives and questions.

Quantitative data were analysed using the Statistical Package for Social Sciences (SPSS) Version 21.0. Descriptive statistics, including frequencies and percentages, summarize responses. Inferential statistics, such as Chi-square and Fisher's Exact Test, examined

associations between respondent characteristics and WASH outcomes. These analyses address Objectives 1, 2, and 3.

Qualitative data, drawn from interviews and observations, were analysed thematically. Responses were transcribed, coded, and grouped into categories reflecting patterns and contrasts. Thematic matrices were used to organize and synthesize insights corresponding to Objective 4. This approach ensured triangulation and enriched understanding of contextual and behavioral influences on effective WASH practices.

4.3 Questionnaire Return Rate

The research aimed to gather data from 381 pupils, 9 teachers, 9 headteachers, 1 Sub-County Director of Education, and 1 County Director of Education. Remarkably, the researcher achieved a 100% response rate from the pupils, teachers, and headteachers, ensuring comprehensive data coverage in the selected schools.

4.4 Characteristics of the Study Participants

According to the survey, many participants were male, between the ages of 13 and 14, and mostly enrolled in Class 7, which is consistent with national upper primary school enrolment trends. The prevalence of Christian affiliation may affect attitudes about hygiene and reflects national demographyInterestingly, just a tiny percentage of respondents said their schools had health clubs, but where they existed, attendance was high. As highlighted in research by Biran et al. (2020) and the World Health Organization (2019b), these observations, compiled in Table 4.0, point to the necessity of bolstering school-based WASH initiatives through age-appropriate and culturally sensitive approaches.

Table 4.0: Characteristics of study respondents (n =381)

	Frequency	Percent
Gender		
Male	203	53.3
Female	178	46.7
Age (Years)		
8 – 10	7	1.8
11 – 12	93	24.4
13 – 14	249	65.4
>14	32	8.4
Education level (Class)		
6	113	29.7
7	177	46.5
8	91	23.9
Religion		
Christian	307	80.6
Muslim	74	19.4
Presence of a health club		
Yes	52	13.6
No	329	86.4
Member of a health club		
Yes	39	75.0
No	13	25.0
Frequency of health club meeting (n =52)		
Daily	13	25.0
Weekly	34	65.4
Monthly	5	9.6

4.5 The Availability of Safe Water in Public Primary Schools in Machakos County

The reported availability of handwashing water in most schools reflects gradual global improvements in WASH services. United Nations Children's Fund and World Health Organization (2023) estimated that 69% of schools worldwide had basic drinking water access in 2020, like the 69.6% of pupils here reporting water for handwashing. However, observations showed that many containers were empty or poorly maintained, and 65.9% relied on buckets with taps, an approach also noted by Abok et al. (2021) as compromising hygiene. Perceptions of irregular water access and inadequate points, reported by nearly a third of pupils, mirror Biran et al. (2020). These findings underscore the need for sustainable water systems to meet WASH standards.

Table 4.1: The availability of safe water in public primary schools in Machakos County

	Frequency	Percent
Provision of hand washing water		
Yes	265	69.6
No	116	30.4
Water provided for hand washing (n = 265)		
Tapped	39	14.7
Water in basins	51	19.4
Water in buckets fitted with taps	175	65.9
Regular Availability of Water for Hand Washing after visiting the Toilet/Latrine		
Strongly agree	113	29.7
Agree	98	25.7
Neutral	45	11.8
Disagree	53	13.9
Strongly disagree	72	18.9
Water points are adequate		
Strongly agree	124	32.5
Agree	88	23.1
Neutral	30	7.9
Disagree	64	16.8
Strongly disagree	75	19.7

4.6 Availability and Effectiveness of Soap

According to Figure 4.0, 51.4% of the students' said soap was always available, 36.5% said it was occasionally available, and 12.1% said it was infrequently available. These results highlight the irregular soap supply in Mavoko Sub-County's public primary schools, which is comparable with larger patterns in sub-Saharan Africa. Just 30% of schools in sub-Saharan Africa provided basic hygiene facilities, such as soap and water, according to the United Nations Children's Fund and World Health Organization (2023). Several handwashing stations were found to be either empty or without soap at the time of the inspection, which was further supported by observations made within the school. A 2024 study by Kabiru et al. further found that irregular soap provision negatively impacts pupils' handwashing frequency, leading to increased vulnerability to hygiene-related illnesses. Similarly, Curtis et al. (2022) reported that many schools with improved water infrastructure still failed to ensure consistent soap availability. These global comparisons support the current study's finding that although many students had access to soap, the inconsistent supply, as evidenced both by pupil responses and direct observations, limits the success of school-based WASH interventions.

Figure 4.0 Availability of soap

4.6.1 Use of Soap at School

As shown in Figure 4.1, 66.4% of pupils reported using soap when washing their hands at school. While encouraging, this still leaves many students without consistent soap use, limiting hygiene effectiveness. Globally, only 51% of schools in low-income countries provide soap (United Nations Children's Fund & World Health Organization, 2023). Ngcongo and Tekere (2023) similarly found that many schools failed to maintain consistent soap supply and reinforce handwashing habits. These results highlight the need to pair soap provision with WASH education and consistent routines.

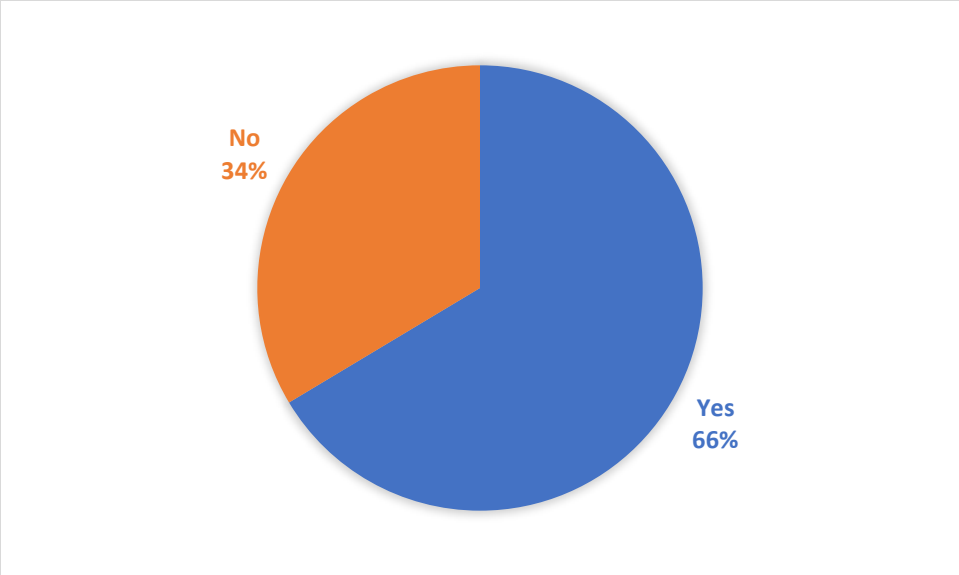


Figure 4.1: Use of soap when washing hands

4.6.2 Thematic Analysis of Soap Availability and Use

The qualitative findings from interviews with headteachers and observation checklists revealed several themes related to soap availability, handwashing behaviours, and institutional strategies supporting hygiene practices. These themes are presented below, supported by illustrative quotations.

Theme 1: Strategic Placement and Visibility of Handwashing Facilities

Many schools indicated that they had set up handwashing stations in visible, convenient spots, including near toilets, dining areas, and classrooms. This strategic placement was intended to encourage pupils to wash their hands regularly and to integrate hygiene into the daily school routine. One headteacher explained: "*We put water and soap stations right next to each toilet block, so children remember to wash their hands as soon as they finish.*"

These practices align with recommendations from the United Nations Children's Fund and World Health Organization (2023), which highlight that having facilities close by increases the likelihood of handwashing. Observations further confirmed that in several schools, the stations were clearly marked and easy for pupils to access.

Theme 2: Behavioural Reinforcement and Incentive-Based Approaches

Several schools implemented creative approaches to encourage pupils to wash their hands regularly. One headteacher shared an example of a peer-led incentive initiative: *"We introduced a 'handwashing champions' program to acknowledge and reward students who consistently maintain good hygiene."* This approach is supported by findings from Nabunya et al. (2021), who observed that pupil-led campaigns can greatly improve hygiene habits. Teachers also remarked that recognizing students publicly strengthened their sense of responsibility and commitment to clean practices.

Theme 3: Integration of Hygiene into Daily School Routines

A recurring theme was the intentional integration of handwashing reminders into daily routines. For instance, one school developed a hygiene song that pupils sang before meals and after using the toilet:

"We have created a handwashing song that students sing before meals and after using the toilet."

This method aligns with Taneja et al. (2020), who found that using interactive and engaging messages helps children form lasting hygiene habits

Theme 4: Parental Involvement and Community Sensitization

Some headteachers highlighted that involving parents was key to maintaining hygiene habits outside of school. One shared:

"We hold regular meetings and workshops with parents to discuss the importance of hygiene. When parents understand, they can support children at home." This approach reflects the recommendations of Jiwani and Antiporta (2022), who observed that parental involvement greatly improves the long-term success of WASH initiatives.

Theme 5: Constraints and Challenges

Although many good practices were described, schools also pointed out ongoing challenges. Limited budgets often made it difficult to maintain a steady supply of soap. One headteacher explained:

"Sometimes, the soap runs out before we can purchase more. We must ration it carefully." Observations confirmed these issues, showing that in some schools, soap dispensers were empty or replaced by makeshift alternatives like pieces of bar soap tied with string.

4.6.3 Summary of Thematic Findings

Overall, the qualitative insights reinforced the quantitative evidence showing that although soap is generally available, and handwashing is practiced, sustaining these behaviors depends on a combination of infrastructure, consistent behavioral reinforcement, and the active involvement of both staff and parents. These findings highlight the importance of comprehensive WASH programs that integrate material resources with continuous education and strong community engagement.

4.7 Overall Effectiveness of Water Provision and Hand Hygiene

Effectiveness was assessed by combining three indicators:

1. Availability of water for handwashing,
2. Regularity of supply,
3. Adequacy of water points.

The findings revealed that 52.2% of the pupils reported adequate WASH practice in terms of water availability and hand hygiene, based on the presence of handwashing water, its regular availability, and adequacy of water points (see Figure 4.2). This indicates moderate progress toward achieving universal access to WASH in schools, as per Sustainable Development Goal 6.1. These results are consistent with a national report by the United Nations Children's Fund and World Health Organization (2023), which found that only 51% of schools in sub-Saharan Africa have access to basic water and hygiene services. Similarly, a study by Abok et al. (2021) in Kenyan public schools reported that just over half had reliable water access, often compromised during dry seasons. This alignment highlights the persistent infrastructural and environmental barriers faced by schools in semi-arid regions such as Machakos County. The moderate adequacy also supports the need for integrated interventions that go beyond installation of water points to include regular maintenance and behavior change strategies that improve usage and sustainability of WASH facilities.

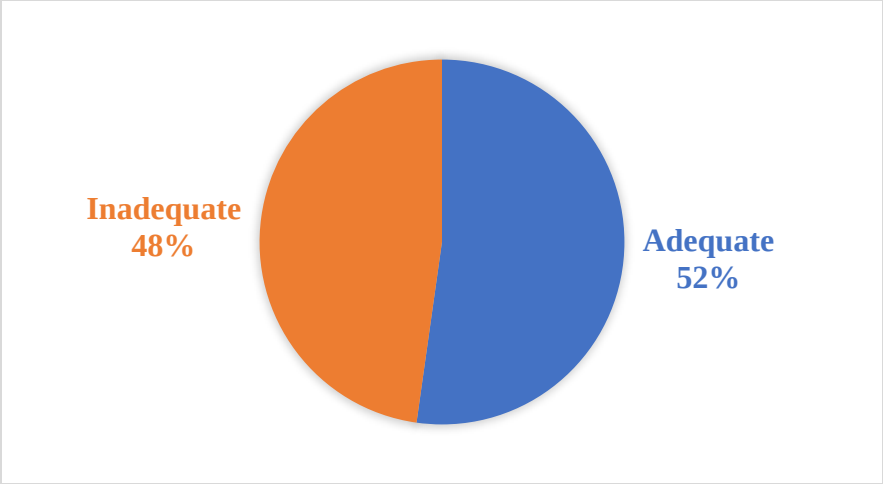


Figure 4.2: Availability of water and hand hygiene

4.8 Factors Associated with Adequate Wash Practice on Safe Water and Hand Hygiene

Analysis revealed that gender, age, and knowledge of WASH practices were significantly associated with adequate water and sanitation practices. The findings from Fisher's Exact Test and Pearson's Chi-Square analysis revealed that gender was significantly associated with adequate safe water and sanitation practices ($\chi^2(1) = 12.01$, $p < 0.001$). Age was also significantly associated with these practices ($\chi^2(3) = 5.684$, $p = 0.029$), as was education level ($\chi^2(2) = 3.583$, $p = 0.009$). Furthermore, knowledge of WASH practices was found to be significantly associated with adequate safe water and sanitation practices ($\chi^2(1) = 10.935$, $p = 0.001$), as presented in Table 4.2

Female pupils reported better hygiene practices compared to males, echoing findings from the United Nations Children's Fund and World Health Organization (2023) that girls often exhibit higher hygiene adherence due to targeted school-based sensitization. Older pupils (>14 years) demonstrated more adequate practices, consistent with WHO & UNICEF (2020) observations that maturity influences behaviour positively. Furthermore, pupils

with better WASH knowledge reported significantly higher levels of safe water and hygiene compliance, reinforcing Abok et al. (2021) view that awareness is a strong determinant of practice.

Table 4.2: Factors associated with adequate WASH practice on hand hygiene

	Water and sanitation				
	Adequate practice n(%)	**Inadequate practice n(%)**	**Chi square**	**df**	**p value**
Gender					
Male	78(38.4)	125(61.6)	12.01	1	<0.001
Female	100(56.2)	78(43.8)			
Age					
8 - 10	1(20.0)	4(80)	5.684	3	0.029
11 - 12	37(43.5)	48(56.5)			
13 - 14	120(49.2)	124(50.8)			
>14	20(64.5)	11(35.5)			
Education level					
6	44(41.1)	63(58.9)	3.583	2	0.009
7	87(51.5)	82(48.5)			
8	47(52.8)	42(47.2)			
Religion					
Christian	143(46.6)	164(53.4)	0.012	1	0.507
Muslim	35(47.3)	39(52.7)			
Presence of health club in school					
Yes	26(50)	26(50)	0.26	1	0.655
No	152(46.2)	177(53.8)			
Member of health club					
Yes	22(56.4)	17(43.6)	2.564	1	0.199
No	4(30.8)	9(69.2)			
Frequency of health meetings					
Daily	5(38.5)	8(61.5)	1.41	2	0.131
Weekly	18(52.9)	16(47.1)			
Monthly	3(60)	2(40)			
Knowledge on Wash practice					
Good	94(56.3)	73(43.7)	10.935	1	0.001
Poor	84(39.3)	130(60.7)			
	39.3%	60.7%			

4.8.1 Thematic Analysis of Safe Water Availability and Sanitation

The qualitative data collected through interviews with headteachers, and observations revealed several recurring themes related to safe water access and sanitation practices in public primary schools. The main themes are summarized below, along with examples to illustrate each point**.**

Theme 1: Reliance on Storage Infrastructure to Manage Water Scarcity

Many schools reported installing large storage tanks and rainwater harvesting systems to cope with frequent interruptions in municipal water supply. These measures were described as critical for ensuring that even basic hygiene needs could be met during dry seasons. One headteacher explained:

"We depend on rainwater harvesting. Without the tanks, there would be no water for even basic cleaning when the sub-county supply fails."

This finding is in line with Abok et al. (2021), who documented similar strategies in other semi-arid areas of Kenya. Observation checklists further confirmed that while most schools did have storage tanks, their maintenance and cleanliness varied widely.

Theme 2: Point-Of-Use Water Treatment and Quality Control

Several respondents described using chlorine tablets or basic filtration methods to make water safe for drinking and handwashing. This practice reflects World Health Organization (2020) recommendations on affordable, point-of-use treatment solutions. As one headteacher explained:

"*Whenever we get water deliveries, we treat it with chlorine tablets to make sure it's safe for the children."*

However, not all schools applied these measures consistently, and some faced budget limitations that restricted how often water treatment could be carried out.

Theme 3: Behavioural Interventions to Promote Safe Water Use

In addition to infrastructure, schools implemented behavioural strategies to encourage safe water handling and hygiene practices. For instance, pupils were asked to bring small containers of clean water from home, and student health clubs led regular awareness campaigns. One respondent shared:

"We have health club members who remind others to use treated water and not to waste it."

This approach aligns with the United Nations Children's Fund and World Health Organization (2023) which emphasizes involving both students and staff in participatory hygiene promotion activities.

Theme 4: Financial Constraints and Sustainability Challenges

Despite notable efforts to improve WASH conditions, most headteachers cited chronic funding shortages as a major obstacle to sustaining an adequate water supply and sanitation services. One respondent remarked:

"The biggest problem is money. Even if we install tanks, we cannot always afford to fill them or repair broken taps."

These constraints are consistent with Kabiru et al. (2024), who found that schools in low-resource settings often struggle to maintain WASH infrastructure over time.

Theme 5: Gaps in Monitoring and Maintenance

Although many schools had invested in water storage and sanitation infrastructure, regular monitoring and maintenance were inconsistent. Observation data revealed cracked tanks, leaking pipes, and discolored water in storage units, all of which undermine the effectiveness of these investments.

4.8.2 Summary of Thematic Findings

Overall, the qualitative data show that while schools are adopting creative and adaptive strategies to improve water availability and sanitation, sustainability is threatened by chronic funding constraints, deteriorating infrastructure, and limited capacity for regular maintenance. These insights reinforce the need for coordinated support among government, communities, and development partners to deliver reliable and safe WASH services in primary schools.

4.9 Sanitation Facilities and Practices in Machakos County Primary Schools

4.9.1 Availability of Washrooms and Sanitation Practices

The study examined the availability and adequacy of sanitation facilities in public primary schools, as summarized in Table 4.3. Findings showed that 69% (n=263) of pupils reported that their schools used pit latrines as the main sanitation facility. However, only 34.9% (n=133) agreed that the washroom facilities were adequate to meet pupil needs. In terms of cleanliness, 54.3% (n=207) strongly agreed that washroom cleaning and disinfection were carried out daily, suggesting some level of commitment to hygiene practices.

These pupil reports were partially supported by observations conducted during school visits. Several latrines were visibly in usable condition; however, some lacked doors or functional locks, and in certain cases, signs of poor maintenance such as overflowing waste or stagnant water were present. This calls into question the adequacy of sanitation infrastructure, particularly in relation to recommendations by the World Health Organization (2020) that advocate for a maximum pupil-to-latrine ratio of 25:1. As discussed, many schools continue to experience overcrowded or poorly maintained facilities, which may compromise privacy, safety, and hygiene for learners. Table 4.3 presents the detailed distribution of responses regarding the availability and cleanliness of school sanitation facilities.

Table 4.3: Availability of washrooms and sanitation practices in Machakos County public primary schools

	Frequency	Percent
Type of washroom available		
Pit Latrine	263	69
Flush Toilet	79	20.7
Both pit latrine and flush toilet	39	10.3
Adequacy of washrooms		
Strongly agree	94	24.5
Agree	133	34.9
Disagree	69	18.3
Strongly disagree	85	22.3
Washroom cleaning and disinfection is done daily		
Strongly agree	207	54.3
Agree	89	23.4
Neutral	21	5.5
Disagree	53	13.9
Strongly disagree	11	2.9

4.9.2 Overall Adequacy Rating of Sanitation Facilities

The adequacy of washroom and sanitation practices was assessed based on pupils' perceptions, whereby adequacy was considered where respondents agreed or strongly agreed that washrooms were sufficient in number and that cleaning and disinfection were carried out daily. According to WHO guidelines, an adequate sanitation facility is defined not only by availability but also by privacy, cleanliness, and a maximum pupil-to-latrine ratio of 25:1 (WHO, 2020). However, this study primarily relied on pupil perceptions as a practical proxy for adequacy in the absence of detailed infrastructure audits. As shown in Figure 4.3, 50.9% (n = 194) of the pupils reported having adequate washroom and sanitation practices. This finding aligns with global evidence. According to the United

Nations Children's Fund and World Health Organization (2023), only about half of schools in sub-Saharan Africa provide adequate sanitation facilities. The results also echo Abok et al. (2021), who observed that although some schools may have basic infrastructure, poor maintenance and overcrowding reduce their effectiveness.These findings were corroborated by observation checklist data and qualitative interviews, which revealed that while most schools had visible latrine structures, many lacked consistent cleaning schedules or displayed signs of neglect such as blocked latrines, broken doors, or overflowing bins. This reinforces the need for greater investment in regular cleaning, infrastructure upgrades, and sustainable sanitation solutions in public primary schools.

Furthermore, the integration of pupil feedback with direct observations emphasizes the importance of participatory monitoring to ensure that facilities remain functional and acceptable to users over time

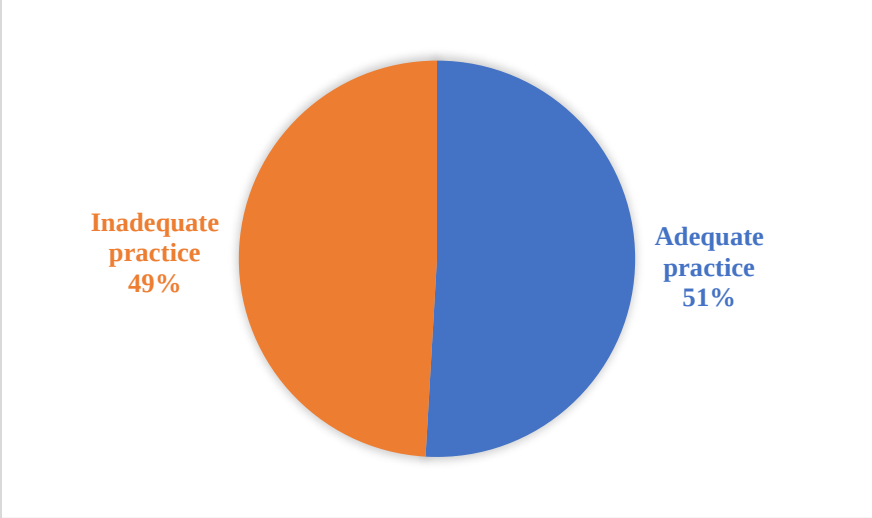


Figure 4.3: Adequacy of washroom and sanitation practices

4.10 Association Between Respondent Characteristics and Sanitation Practice Adequacy

The findings showed that there was significant association between gender and adequacy of washroom and sanitation practices ($\chi^2(1) = 3.70$, $p = 0.034$). There was also statistically significant association between presence of a health club and adequacy of washroom and sanitation ($\chi^2(1) = 24.195$, $p < 0.001$). Being a member of a health club was significantly associated with adequacy of washroom and sanitation practices, as shown in Table 4.4. These findings suggest that gender influences hygiene behaviors, with female pupils demonstrating better adherence. This aligns with findings by Sommer et al. (2022), who noted that girls often engage in hygiene-related initiatives, especially when proper facilities and sensitization are available. The presence of health clubs also plays a critical role, supporting findings by the United Nations Children's Fund and World Health Organization (2023), which emphasized the impact of student-led initiatives in promoting WASH practices. Being an active member of such clubs likely increases awareness and participation, as supported by Kabiru et al. (2024), who highlighted the role of peer-led hygiene campaigns in enhancing school-level sanitation engagement.

Table 4.4: Association between respondent characteristics and adequacy of washroom and sanitation practices

	Washroom sanitation				
	Adequate practice n(%)	**Inadequate practice n(%)**	**X**	**df**	**p value**
Gender					
Male	94(46.3)	109(53.7)	3.70	1	0.034
Female	100(56.2)	78(43.8)			
Age					
8 - 10	3(60)	2(40)	1.375	3	0.711
11 - 12	38(44.7)	47(55.3)			
13 - 14	124(50.8)	120(49.2)			
>14	14(45.2)	17(54.8)			
Education level					
6	45(42.1)	62(57.9)	3.67	2	0.159
7	91(53.8)	78(46.2)			
Religion					
Christian	153(49.8)	154(50.2)	0.74	1	0.438
Muslim	41(55.4)	33(44.6)			
Presence of health Education					
Yes	10(19.2)	42(80.8)	24.195	1	<0.001
No	184(55.9)	145(44.1)			
Member of health club					
Yes	6(15.4)	33(84)	1.486	1	0.024
No	4(30.8)	9(69.2)			
Frequency of health meetings					
Daily	3(23.1)	10(76.9)	3.21	2	0.415
Weekly	6(17.6)	28(82.4)			
Monthly	1(20)	4(80)			
Knowledge of WASH practices					
Good	79(47.3)	88(52.7)	1.55	1	0.217
Poor	115(53.7)	99(46.3)			

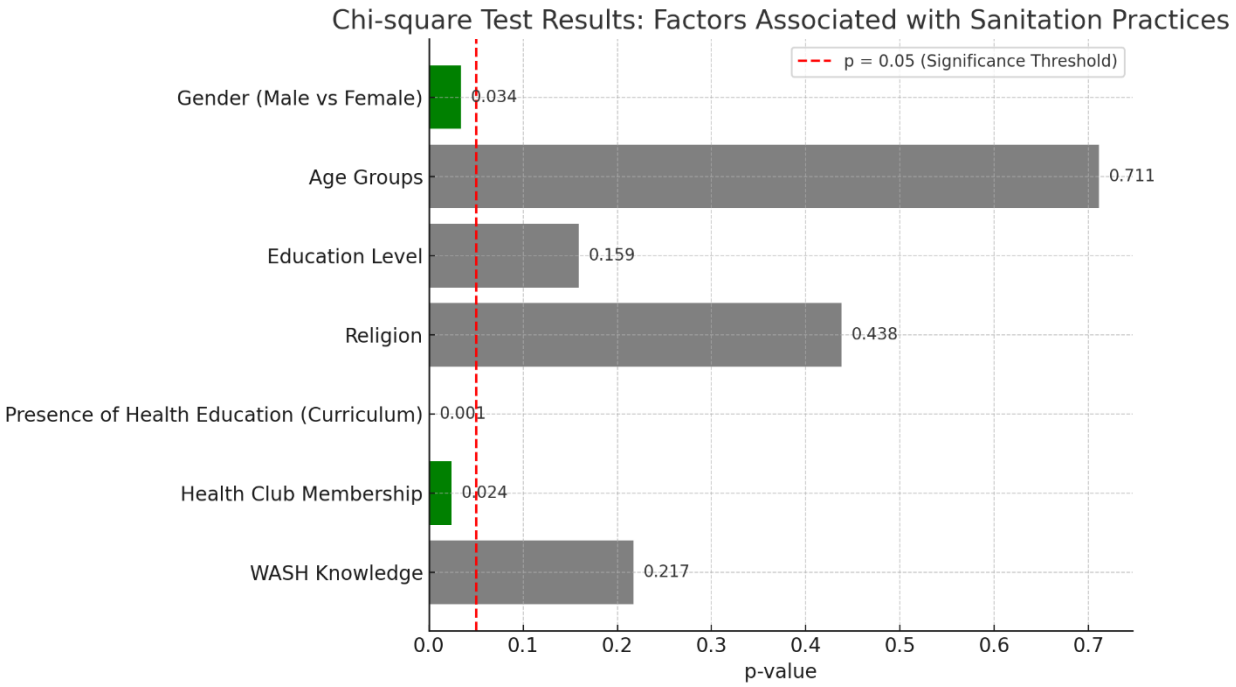


Figure 4.4.: Factors associated with Sanitation Practices (Chi-Square Test Results)

4.10.1 Thematic Analysis of Sanitation Facilities among Primary School Pupils

This section presents qualitative findings drawn from interviews, observations, and two focus group discussions conducted in Kinanie and Athi River zones. The FGDs involved teachers, health club patrons, and pupil representatives. Although the limited number of FGDs constrained the breadth of perspectives, the insights provide valuable context for understanding sanitation practices and challenges in the study area. Five main themes emerged:

Theme 1: Structured Cleaning Routines and Staff Commitment

Both interviews and FGDs revealed that some schools had implemented structured cleaning routines supported by dedicated staff. For example, during an FGD in Athi River, one teacher shared:

"Our school has set up a schedule where the toilets are cleaned every morning and after lunch. We also assign pupils to check that the facilities are tidy." This was reinforced in an interview:

"We have a dedicated cleaning staff that ensures the toilets are cleaned twice a day. We also involve students in hygiene education programs to teach them the importance of keeping the facilities clean." (Head Teacher 2).

Observation checklists confirmed that in several schools, cleaning rosters were displayed prominently.

Theme 2: Overcrowding and Insufficient Facilities.

Overcrowding was consistently raised across the discussions. In Kinanie, a health club patron explained:

"We have too few toilets for the number of children. During breaks, there is always a queue, and some pupils avoid using the latrines altogether." A similar concern was echoed in interviews:

"The sanitation facilities are not adequate for our large student population. We have too few toilets, and they often become overwhelming, especially during peak times." (Head Teacher 3)

These accounts were supported by observation data, which documented blocked entrances and long waiting lines.

Theme 3: Maintenance Gaps and Poor Infrastructure

Participants frequently reported challenges related to poor maintenance. In an FGD, a teacher noted:

"Sometimes the doors are broken, and there is no privacy, especially for the older girls."

Observational data confirmed these issues, with several latrines lacking doors or showing visible waste accumulation. One headteacher summarized:

"*The facilities are far from adequate. We have a limited number of toilets, which are often in poor condition due to overuse and lack of proper maintenance." (Head Teacher 1)*

Theme 4: Positive Impact of External Support

While many schools struggled, a few had received external support that led to improvements. A teacher in Athi River shared:

"An NGO supported us with funds to repair the latrines and train our cleaning staff. It has made a big difference."

This mirrors observations by Oketch et al. (2020), who noted that NGO partnerships are vital in strengthening school WASH infrastructure.

Theme 5: Behavioural Reinforcement and Student Engagement

Both FGDs described efforts to involve pupils in sanitation management. One health club patron explained:

"We have a hygiene club that teaches children how to clean the washrooms and why it matters."

This was consistent with interviews and was supported by observations of posters and hygiene education materials displayed near latrine blocks.

4.10.2 Summary of Thematic Insights

Overall, the findings indicate that while some schools have instituted structured cleaning and student engagement programs, persistent challenges remain due to overcrowding, infrastructure gaps, and inconsistent maintenance. The limited number of FGDs means that some perspectives, particularly those of pupils, may not be fully represented. Nevertheless, the qualitative data triangulated with quantitative findings to provide a nuanced understanding of sanitation practices and barriers in public primary schools in Machakos County.

CHAPTER 5: DISCUSSIONS

5.1 Introduction

Promoting public health in public primary schools requires clean restrooms, consistent access to soap, and a reliable supply of safe water. Inadequate Water, Sanitation, and Hygiene (WASH) services directly contribute to disease outbreaks, increased absenteeism, and negative educational and psychosocial outcomes. This discussion interprets the study's findings considering the research objectives, the BASNEF model, existing literature, and global WASH benchmarks, while also highlighting implications for policy, program design, and practice.

5.2 Availability of Safe Water and Handwashing Practices

The quantitative data revealed that 52.2% of pupils reported adequate handwashing and water hygiene practices, indicating that just over half regularly accessed safe water for hygiene. While this proportion is moderately encouraging, it also shows that nearly half of pupils still experienced unreliable provision, a gap with significant health implications. This figure is comparable to estimates by the United Nations Children's Fund and World Health Organization (2023), which found that only 51% of schools in Sub-Saharan Africa met minimum standards for basic water and hygiene services.

Observational findings during school visits reinforced these perceptions. In several schools, water points were empty, poorly maintained, or operational only part of the day. Many relied on buckets fitted with taps rather than piped water, highlighting systemic

infrastructure limitations similar to those described by Oketch et al. (2020) in Kenyan schools.

Thematic insights from headteacher interviews and focus group discussions further illustrated these challenges. Infrastructural limitations were a recurring theme, with schools relying on inconsistent rainwater harvesting and communal boreholes. During dry seasons, some headteachers asked pupils to bring water from home, creating extra burdens and inequities for poorer families.

This situation underscores the gap between policy and practice. Although Sustainable Development Goal 6.1 aims for universal access to safe water by 2030, progress remains limited. The BASNEF model reinforces that even with positive attitudes, lack of reliable infrastructure prevents sustained hygiene practices.

5.2.1 Policy and Practice Implications

To close this infrastructure gap, local governments, school boards, and community partners should prioritize**:**

i. Establishing dedicated WASH budgets within school operational funding,
ii. Installing large-capacity rainwater harvesting and filtration systems,
iii. Implementing regular maintenance and real-time monitoring to reduce water point downtime, and
iv. Integrating accountability structures, such as school health committees, to ensure resources are used effectively.

5.3 Availability and Use Of Soap

The findings showed that 51.4% of pupils reported that soap was always available, 36.5% said it was only sometimes available, and 12.1% indicated it was rarely or never provided. Although this suggests modest improvement over older surveys, nearly half of pupils still faced inconsistency; a critical challenge since handwashing with soap can reduce diarrheal disease incidence by up to 48% (Freeman et al., 2020).

Observation checklists consistently documented empty soap containers by midday. This highlights a common pattern where WASH interventions focus on installing infrastructure but lack plans for reliably restocking consumables.

Thematic analysis revealed two main themes. The first, Behaviour-Centred Promotion, captured schools' creative efforts, such as hygiene songs, "handwashing champion" competitions, and teacher-led demonstrations. These initiatives reflect recommendations by Curtis et al. (2022), who stress that behaviour-centred design can help children internalize hygiene habits.

However, the second theme, Resource Constraints, underscored that even the best strategies were often undermined by irregular funding and theft. As one headteacher shared during an FGD, *"No matter how much we teach, if there is no soap on the stand, it does not work."*

These findings reinforce a core insight from the BASNEF model: enabling factors are non-negotiable foundations for sustaining healthy behaviour. The tension between strong awareness and chronic material shortages remains a persistent challenge in low-resource settings.

5.3.1 Policy Implications

Sustainable soap provision requires:

i. Establishing supply contracts with local manufacturers or cooperatives,
ii. Allocating dedicated budgets within school operating funds,
iii. Installing secure soap dispensers to reduce theft, and
iv. Regularly monitoring supply and use.

5.3.2 Research Implications

Future studies should explore low-cost behavioural nudges such as visual cues and child-friendly dispensers paired with financing models that ensure soap is consistently available over time.

5.4. Sanitation Facilities and Practices

The quantitative data revealed that 69% of pupils reported pit latrines as their main sanitation facility, yet only 34.9% considered them adequate. While more than half of students indicated that toilets were cleaned daily, observational evidence showed significant inconsistencies. Some schools maintained clean and usable latrines, but others had overflowing waste, broken doors, and no soap or water nearby. This discrepancy underscores an important reality: simply having sanitation facilities does not ensure they meet acceptable standards. According to the World Health Organization (2020), schools should maintain a maximum pupil-to-latrine ratio of 25:1, with separate, private, and clean facilities for girls and boys. None of the schools in this study consistently met these benchmarks, mirroring findings by Oketch et al. (2020), who reported that more than 60% of rural schools in Kenya failed to achieve basic latrine adequacy.

Thematic insights reinforced these patterns. Overcrowding emerged as the most frequently cited concern, as headteachers described how school expansions driven by free primary education outpaced investments in sanitation infrastructure. Another recurring theme was the role of Community and NGO Support: while some schools received funding from external partners to build latrines, they often struggled to maintain them over time due to resource constraints.

Gender considerations were also prominent. Consistent with Sommer et al. (2022), this study found that girls were disproportionately affected by inadequate privacy and sanitation conditions. This dynamic can contribute to absenteeism during menstruation, lower classroom participation, and psychosocial distress.

5.4.1 Policy and Practice Implications

Addressing these deficits will require:

i. Urgent investments in constructing additional sanitation units to meet minimum ratios,
ii. Ring-fenced budgets for cleaning materials and dedicated staff,
iii. Gender-sensitive design features such as menstrual hygiene disposal facilities, and
iv. Regular monitoring of school sanitation against WHO minimum standards.

5.5 Factors Associated with Wash Practice

This study identified statistically significant associations between gender, age, WASH knowledge, and the adequacy of hygiene practices. Female pupils, older students, and those with higher levels of WASH knowledge demonstrated more consistent behaviours, aligning with findings by Morgan et al. (2017), who underscored the importance of knowledge and prevailing social norms as predictors of hygiene compliance.

Thematic interpretation further reinforced these patterns, revealing that schools which integrated hygiene messaging into daily routines or leveraged peer influence observed notably better hygiene practices among pupils. In contrast, schools without structured programs or designated health clubs often experienced higher rates of non-compliance and poorer hygiene outcomes.

From a policy perspective, these findings highlight the need to embed hygiene education within the formal curriculum, support the establishment of health clubs and student WASH ambassador initiatives, and prioritize teacher training in behaviour-centered WASH promotion approaches.

5.6 Integration of Quantitative and Qualitative Findings

The triangulation of quantitative surveys, observational checklists, and thematic insights revealed a consistent narrative. While infrastructural improvements have been initiated across many schools, their distribution remains uneven, and persistent resource scarcity continues to undermine sustainability. Behaviour-centered initiatives and positive reinforcement strategies have shown promise in bridging some of these gaps, yet they cannot fully compensate for deeper structural inadequacies.

This combined perspective underscores the BASNEF model's assertion that beliefs, attitudes, subjective norms, and enabling factors interact dynamically to shape hygiene practices. It also reinforces that effective policy solutions must extend beyond infrastructure installation to include predictable funding, regular training, and systematic monitoring to sustain improvements over time.

5.7 Implications for Policy, Programming, and Research

The findings point to several important implications for policy, programming, and future research. From a policy perspective, governments should prioritize integrating WASH investments within broader school development plans, while local education authorities should set aside dedicated funds to regularly buy essential supplies like soap and water treatment materials. Monitoring frameworks must also evolve to track not only the existence of infrastructure but its usability, cleanliness, and adequacy to meet pupil needs.

At the programming level, hygiene promotion activities should leverage culturally resonant strategies such as songs, peer-led recognition, and health clubs to foster sustainable behaviour change. Standardized maintenance routines and regular oversight are essential to keep facilities functional and safe. Importantly, gender-sensitive solutions including private toilette spaces and menstrual hygiene support must be prioritized to ensure equity and dignity for all pupils.

For research, there is a need to explore innovative financing models that can support consistent replenishment of consumables in resource-limited settings. Additionally, longitudinal studies could provide valuable insights by tracking how improvements in

infrastructure and behaviour change interventions influence attendance, health outcomes, and educational performance over time.

5.8 Conclusion

In summary, this study shows that improving WASH in public primary schools requires combining investment in reliable infrastructure and regular supplies of essentials like soap and clean water with ongoing hygiene education and support. Addressing both physical resources and behaviour is key to meeting national standards and achieving global goals such as Sustainable Development Goal 6.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Limitations of the Study

Although the study achieved a high response rate from pupils, teachers, and headteachers in Mavoko Sub-County, several limitations were encountered.

First, due to time, logistical, and administrative constraints, the researcher could not engage key external stakeholders such as local non-governmental organizations, Ministry of Health public health officers, and project coordinators responsible for WASH interventions in the area. This limited the ability to explore partnerships, community support systems, and the influence of externally funded programs on WASH practices.

Second, while questionnaire and interview data were complemented by observations, the observation checklist was constrained by time. Some facilities were inaccessible during the visits, and observations only captured conditions at a single point in time. As a result, seasonal changes and day-to-day differences in cleanliness and supply could not be fully documented.

Third, only two focus group discussions were held, and participation was lower than expected. This reduced the range of qualitative insights from teachers and pupils.

Lastly, the reliance on self-reported practices may have introduced social desirability bias, as some students could have overstated their hygiene behaviours to give a favourable impression.

These limitations should be considered when interpreting the study's findings and highlight areas for improvement in future research.

6.2 Conclusion

This study set out to assess the factors influencing the effectiveness of Water, Sanitation, and Hygiene (WASH) practices in public primary schools in Mavoko Sub-County, Machakos County. The conclusions below are presented in line with the study objectives:

Objective 1: Availability of Safe Water and Handwashing Facilities

The findings showed that 52.2% of pupils reported having adequate access to safe water and handwashing facilities. While this indicates some progress, nearly half of the respondents still faced unreliable water supply and inconsistent access to functional handwashing stations. Observations confirmed these gaps, including dependence on buckets instead of piped water and frequent shortages during the school day. These issues highlight major infrastructure and operational weaknesses that limit effective hygiene practices.

Objective 2: Availability and Adequacy of Sanitation Facilities

Regarding sanitation, 69% of pupils reported that their schools relied mainly on pit latrines. Only 34.9% considered these facilities adequate, raising concerns about overcrowding, lack of privacy, poor maintenance, and limited gender-sensitive provisions. Observation checklists supported these perceptions, revealing latrines without doors, blocked waste, and shortages of cleaning materials. Although more than half of the pupils' said toilets were cleaned daily, this was not consistently practiced. Overall, inadequate sanitation facilities remain a significant obstacle to achieving safe and inclusive WASH standards.

Objective 3: Socio-Behavioural and Institutional Factors Influencing WASH Practices

The study found significant links between gender, age, WASH knowledge, and hygiene behaviours. Female pupils and older students tended to follow hygiene practices more consistently. Schools with active health clubs and hygiene education programs reported better compliance. Qualitative insights showed that factors such as having soap available, structured routines, and teachers demonstrating hygiene were essential for sustaining good practices. However, limited resources, overcrowding, and poor facility maintenance often undermined these efforts.

In summary, while notable progress has been made in improving WASH in public primary schools, ongoing challenges remain. Infrastructural shortcomings, irregular resources, and gaps in behavioural reinforcement continue to limit the effectiveness and fairness of hygiene practices. Overcoming these challenges will require a coordinated approach that combines investments in infrastructure, continuous training, and stronger accountability measures.

6.3 Recommendations

Based on the findings, the following actions are recommended:

1. **Expand Sanitation Infrastructure**

   Responsible Entity: Ministry of Education, County Government, School Boards
   Construct more toilets to reduce overcrowding, ensure gender-segregated facilities, and provide menstrual hygiene resources.

2. **Improve Water Supply Systems**

Responsible Entity: MoE Infrastructure Department, County Water Boards, NGOs
Install piped water or rainwater harvesting systems and allocate funds for regular maintenance.

3. **Allocate Budgets for Consumables**

Responsible Entities: School Boards, County Education Departments
Create dedicated budget lines for soap and cleaning supplies. Use secure dispensers to reduce theft.

4. **Strengthen Hygiene Promotion**

Responsible People: School Committees, Teachers, Health Clubs
Integrate hygiene education into daily routines using participatory methods like songs and peer-led activities.

5. **Promote Community Partnerships**

Responsible Persons: School Administrators, PTAs, Local NGOs
Engage NGOs and community groups to support infrastructure, training, and supplies.

6. **Conduct Regular Monitoring**

Responsible: County Public Health Officers, MoE Quality Assurance
Carry out bi-annual audits to assess WASH conditions and guide improvements.

6.4 Suggestions for Future Research

Future studies should:

i. Track the long-term impact of infrastructure and hygiene programs to assess sustained behaviour change.

ii. Compare WASH practices in rural and urban schools to identify context-specific challenges and solutions.

iii. Explore effective models of collaboration between schools, NGOs, and communities for sustainable funding and maintenance.

iv. Examine how gender-responsive sanitation affects girls' attendance and wellbeing.

v. Assess the role of behavioural nudges and incentives in improving hygiene compliance cost-effectively.

REFERENCES

Abok, K., Waweru, D., & Mwangi, P. (2021). Challenges in implementing school WASH programs in Kenya: An evaluation of infrastructure and behavioral determinants. *African Journal of Environmental Health*, *27*(2), 112–124.

Adinma, E. D., & Adinma, J. I. (2018). Perceptions and practices on menstruation among Nigerian secondary school girls. *African Journal of Reproductive Health*, *12*(1), 74–83.

African Institute for Health Development. (2018). *Personal hygiene and sanitation education (PHASE) – End of project evaluation*. http://www.un.org/milleniumgoals/

Almedom, A. M., Blumenthal, U., & Manderson, L. (1996). *Hygiene evaluation procedures: Approaches and methods for assessing water and sanitation-related hygiene practices*. Intermediate Technology Publications.

Antwi-Agyei, P., Peasey, A., & Bruce, J. (2017). Gender and sanitation practices in schools. *Water International*, *42*(5), 654–667.

Asyago, B. (2017). *An investigation into the challenges facing the free primary education management: The case of Machakos District, Kenya* [Unpublished master's thesis]. Kenyatta University.

Babbie, E. (2021). *The practice of social research* (9th ed.). Wadsworth Thomson.

Biran, A., Schmidt, W.-P., Varadharajan, K. S., Rajaraman, D., Kumar, R., Greenland, K., Gopalan, B., Aunger, R., & Curtis, V. (2020). Effect of a behavior-change

intervention on handwashing with soap in India (SuperAmma): A cluster-randomized trial. *The Lancet Global Health*, *2*(3), e145–e154.

Bogdan, R. C., & Biklen, S. K. (1992). *Qualitative research for education: An introduction to theory and methods*. Allyn & Bacon.

Boot, M. T., & Cairncross, S. (2017). *Actions speak: The study of hygiene behaviour in water and sanitation projects*. IRC International Water and Sanitation Centre.

Borg, R. W., & Gall, D. M. (2020). *Educational research: An introduction*. Longman.

Bowling, A. (1999). *Research methods in health: Investigating health services*. Open University Press.

Cairncross, S. (2018). Why promote sanitation and hygiene? [Unpublished manuscript]. UNICEF Workshop on Environmental Sanitation.

Cairncross, S., & Valdmanis, V. (2006). Water supply, sanitation and hygiene promotion. In D. T. Jamison et al. (Eds.), *Disease control priorities in developing countries* (2nd ed., pp. 771–792). Oxford University Press & The World Bank.

Cronk, R., Slaymaker, T., & Bartram, J. (2021). Monitoring drinking water, sanitation, and hygiene in non-household settings: Priorities for policy and practice. *International Journal of Hygiene and Environmental Health*, *234*, Article 113746. https://doi.org/10.1016/j.ijheh.2020.113746

Curtis, V., Schmidt, W., Luby, S., Florez, R., Toure, O., & Biran, A. (2022). Hygiene: New hopes, new horizons. *The Lancet Infectious Diseases*, *11*(4), 312–321.

Freeman, M. C., Garn, J. V., Sclar, G. D., Boisson, S., Medlicott, K. O., Alexander, K. T., Penakalapati, G., Anderson, D., Mahtani, A. G., & Clasen, T. F. (2020). The impact of sanitation on infectious disease and nutritional status: A systematic review and meta-analysis. *International Journal of Hygiene and Environmental Health*, *220*(6), 928–949.

Garn, J. V., Sclar, G. D., Freeman, M. C., Penakalapati, G., Alexander, K., Brooks, P., Rehfuess, E., & Boisson, S. (2020). The impact of sanitation interventions on latrine coverage and latrine use: A systematic review and meta-analysis. *International Journal of Hygiene and Environmental Health*, *220*(2), 329–340.

Inter-Agency Network for Education in Emergencies. (2020). *WASH in schools: A guide for implementation*. https://inee.org

Jiwani, S. S., & Antiporta, D. A. (2022). Barriers and facilitators for implementing water, sanitation and hygiene (WASH) interventions in schools in low-resource settings. *International Journal of Environmental Research and Public Health*, *19*(1), Article 298. https://doi.org/10.3390/ijerph19010298

Kabiru, C., Oremo, O., & Wambua, D. (2024). The role of soap availability in promoting school handwashing practices: A case study in Kenyan primary schools. *East African Journal of Public Health*, *11*(1), 15–25.

Kenya National Bureau of Statistics. (2023). *Kenya population and housing census – Machakos County analytical report*. https://www.knbs.or.ke/?wpdmpro=machakos-county-analytical-report

Machakos County Health Department. (2019). *Annual health status report for Machakos County: Focus on WASH-related illnesses*. County Government of Machakos.

Mara, D., & Evans, B. (2018). The sanitation and hygiene targets of the Sustainable Development Goals: Scope and challenges. *Journal of Water, Sanitation and Hygiene for Development*, *8*(1), 1–16.

McMichael, C. (2019). Water, sanitation and hygiene (WASH) in schools in low-income countries: A review of evidence of impact. *International Journal of Environmental Research and Public Health*, *16*(3), Article 359. https://doi.org/10.3390/ijerph16030359

Ministry of Education, Science and Technology. (2019). *Kenya education sector support report*. Government of Kenya.

Ministry of Health. (2018). *National environmental sanitation and hygiene policy*. Government of Kenya.

MoE. (2016). *National school health guidelines*. Government Press.

MoE. (2017). *Education situation analysis*. Government Press.

MoE. (2018). *Education facts and figures*. Government Press.

MoE. (2019). *Basic report on spatial analysis of school mapping*. Government Press.

MoE. (2020). *Education situation analysis*. Government Press.

MoH. (2019). *National environmental sanitation and hygiene policy*. Government of Kenya.

Morgan, P., Wilson, J., & Tekere, M. (2017). Linking sanitation access and health outcomes in schools. *Journal of Water, Sanitation and Hygiene for Development, 7*(4), 634–643.

Mugenda, A. A. (2003). *Research methods in quantitative and qualitative approaches*. Acts Press.

Mugenda, O. M., & Mugenda, A. G. (1999). *Research methods: Quantitative and qualitative approaches*. Africa Centre for Technology Studies Press.

Mulwa, F. (2006). *Participatory monitoring and evaluation of community projects*. Zapf Chancery and Polivex.

Mwaniki, P. A. (2015). A partnership approach in improving school sanitation and hygiene in Kenya. In *Symposium on Learning Alliances for Scaling Up Innovative Approaches in the Water and Sanitation Sector*.

Nabunya, C., Tumwebaze, I., & Kansiime, F. (2021). Peer-led hygiene promotion in schools: An effective behavior change strategy. *International Journal of Environmental Health Research*, *31*(2), 200–213.

Ngcongo, N., & Tekere, M. (2023). Evaluating hygiene education and its role in improving school WASH practices. *African Journal of Public Health*, *15*(2), 231–240.

Oketch, J., Otieno, R., & Waweru, D. (2020). Partnerships for school WASH improvements: The role of NGOs and community-based organizations. *Waterlines*, *39*(3), 249–261.

Snel, M. (2019). *School sanitation and hygiene education*. IRC International Water and Sanitation Centre.

Sommer, M., Schmitt, M. L., Clatworthy, D., Bingham, T., & Ratnayake, R. (2022). Evidence review of menstruation and gender in WASH. *Waterlines*, *41*(1), 27–45.

SWASH. (2019). *Sustaining and scaling school-based water, sanitation and hygiene plus community impacts*. The Centre for Global Safe Water, Emory University.

Taneja, J., Chaturvedi, M., & Kumar, A. (2020). School-based hygiene interventions using songs and games: Impacts on children's handwashing behavior. *Indian Journal of Public Health*, *64*(3), 253–259.

Tekere, M., Ngcongo, N., & Wilson, J. (2023). Poor WASH practices and student health outcomes: A Kenyan perspective. *Journal of School Health*, *93*(1), 45–53.

United Nations Children's Fund. (2018). *Water, sanitation and hygiene*. United Nations Children's Fund.

United Nations Children's Fund and World Health Organization. (2023). *Progress on drinking water, sanitation and hygiene in schools: 2000–2022 data update*. United Nations Children's Fund & World Health Organization.

World Health Organization. (2020). *International decade for action: Water for life*. World Health Organization.

APPENDICES

APPENDIX I: Questionnaire

Dear Participant,

I am an AMREF International University Master of Public Health student researching WASH-related morbidity among school students in Machakos County. All respondents are guaranteed of confidentiality. Your participation and contribution will be greatly appreciated.

Thanks.

SECTION A: DEMOGRAPHIC CHARACTERISTICS

1. Name of the school……
2. Sex Male ( ) Female ( )
3. Age ( )
4. Level of education ( )
5. Religion: Christian [ ] Muslim [ ] African Traditional religion [ ] None [ ]

	Question statement	Choices	Code
6	Do you have a health club in your school?	Yes No	1 2
7	Are you a member of the school health club?	Yes No If No go to part A	1 2 3
8	If you are a member of the school health Club, how often does the School Health Club meet?	Daily Weekly Monthly	1 2 3
9	If yes, what hygiene and sanitation related activities are these clubs involved in?	Drama, music, poetry Clean-ups Peer education on health issues Other (Specify)	1 2 3 4
10	Have you met since the term began?	Yes No	1 2
SECTION B: KNOWLEDGE			
15	What water treatment methods do you know of?	None Chlorination Boiling Distilling/Filter Use of water guard Store in clean containers	1 2 3 4 5 6
16	What diseases can one get by taking dirty water or bathing in dirty water	Diarrhea Typhoid Bilharzia Cholera Don't know	1 2 3 4 5
17	Can diarrhea be prevented in the following ways	Washing hands before eating Eating clean food/fruits Drinking safe/clean water Boiling drinking water Using latrines Covering food Keeping nails short washing hands after toilet Clean environment	1 2 3 4 5 6 7 8 9
18	Which of the following are the effects of poor personal hygiene?	Intestinal worms Diarrheal diseases Eye diseases	1 2 3

		Skin diseases Lice infestation Bed bugs infestation Jiggers/ fleas infestation	4 5 6 7
19	Are the following symptoms of worm infection?	Swollen stomach Body Weakness Diarrhea Stomach pain/ache Scratching/Itchy skin Lack of appetite Persistent hunger Weight loss Brownish hair Worms seen in stool	1 2 3 4 5 6 7 8 9 10
20	Can we prevent being infected by worms in the following ways?	Avoid eating soil Avoid eating dirty food Drink boiled water Wash hands before eating Wash hands after using toilet Wash hands before cooking Cut nails Eat well cooked food Use latrines Wear shoes Other: (Specify)……	1 2 3 4 5 6 7 8 9 10
21	What is your main source of hygiene and sanitation information?	Teacher Health Clubs at school Parents Health/social workers Other specify……	1 2 3 4 5
SECTION C: LEVEL OF IMPLEMENTATION OF HYGIENE PRACTICES			
22	Are you being taught hygiene practices in this school?	Yes No	1 2
23	If yes, how often are these lessons given?	Daily Weekly Monthly	1 2 3

24	Does your school participate in any hygiene activities?	Yes No	1 2
25	If yes which one?	Clean ups Garbage collection Open days	1 2 3
26	Do you brush/clean your teeth every morning?	Yes No	1 2
27	What do you use to brush /clean your teeth?	Tooth brush and paste Piece of cloth and salt Stick Toothbrush and salt water Finger brushing Gargle salty water Does not brush teeth	1 2 3 4 5 6 7
28	Do you wash your face every morning?	Yes No	1 2
29	Do you bathe every day?	Yes No	1 2
30	What do you use for Bathing?	Soap and water [Water only Other (specify)……	1 2 3
31	Do you wash your hands after using the toilet at home?	Yes No	1 2
32	Do you wash your hands after using the toilet at school?	Yes No	1 2
33	What type of materials do you use for anal cleansing?	Paper Tissue paper Leaf Water Nothing Other (specify)….....	1 2 3 4 5 6
34	Do you clean your clothes after single use	Yes No	1 2
35	Do you wear sandals or another footwear while outdoors?	Yes No	1 2
36	Do you use a handkerchief when coughing/sneezing/spitting?	Yes No	1 2

37	Do you always dispose solid waste at designated points (bins/pits etc.)?	Yes No	1 2
38	Do you share health messages with other children, parents and other community members?	Yes No	1 2
PART D: HYGIENE TECHNOLOGIES			
39	Do you have water in school always?	Yes No	1 2
40	What is the source of the water in your school?	Tap water Tanks water Bring from home Buy from vendors	1 2 3 4
41	How do you usually wash hands in school?	Do not wash hands Share a common container Running water	1 2 3
42	Do you usually use soap when washing your hands at home?	Yes No	1 2
43	Do you usually use soap when washing your hands in school?	Yes No	1 2
44	Do you have a toilet that is in use at school?	Yes No	1 2
45	If yes, what type of toilet do you have	Urinal Ordinary pit latrine VIP latrine Flush toilet	1 2 3 4
46	If no, where do you go?	River Bush Trenches Dump site Use flying toilet Pay for toilet elsewhere Other (specify)…….	1 2 3 4 5 6 7

APPENDIX II: Head Teachers' Interview Guide

Introduction:

Dear Participant,

I am a Master of Public Health student at Amref International University carrying out research on factors influencing the effectiveness of Water, Sanitation, and Hygiene (WASH) practices in public primary schools in Machakos County. Your participation is voluntary, and all responses will be kept confidential. Thank you for your time and contribution.

a) What types of sanitation facilities does the school currently have for pupils? *(e.g., pit latrines, flush toilets)*

b) Do you feel these facilities are adequate for the number of pupils enrolled? Why or why not?

c) How often are the toilets cleaned and maintained?

d) What challenges do you face in keeping sanitation facilities functional and clean?

e) What improvements would you recommend to enhance sanitation facilities?

f) What sources of water are available for pupils' daily use at the school?

g) Is water consistently available for handwashing throughout the day?

h) Where are handwashing stations located in relation to the toilets and classrooms?

i) Does the school provide soap for handwashing? If yes, what type?

j) Is the quantity of soap sufficient for the number of pupils?

k) What provisions are in place for menstrual hygiene management, such as disposal bins?

l) Are these disposal facilities adequate for the number of girls in the school?

m) What challenges, if any, do you face in providing menstrual hygiene resources?

n) How does the school promote hygiene behaviour among pupils? *(e.g., health clubs, demonstrations, campaigns)*

o) In your view, what actions are most needed to improve WASH practices in your school?

APPENDIX III: Sub-County Education Officer Interview Guide

Introduction:

Dear Participant,

I am a Master of Public Health student at Amref International University conducting research on *factors influencing the effectiveness of Water, Sanitation, and Hygiene (WASH) practices in public primary schools in Machakos County*. Your responses will be treated confidentially. Thank you for your support.

a) In your role, how do you participate in decisions about WASH provision in schools?

b) What training or guidance do you provide to teachers or school administrators on WASH-related practices?

c) What improvements would you like to see in WASH infrastructure and hygiene promotion in schools?

d) What challenges do schools face in sustaining good hygiene practices among pupils?

e) What kind of support or collaboration exists with NGOs, community organizations, or donors to improve school WASH conditions?

f) What recommendations do you have for strengthening WASH practices in public primary schools?

APPENDIX IV: County Education Officer Interview Guide

Introduction:

Dear Participant,

I am a Master of Public Health student at Amref International University carrying out research on *factors influencing the effectiveness of Water, Sanitation, and Hygiene (WASH) practices in public primary schools in Machakos County*. Your input is highly valued and will remain confidential.

a) What is the current estimated number of pupils enrolled in public primary schools in Machakos County?

b) What are the main challenges related to water, sanitation, and hygiene in these schools?

c) What immediate needs do schools have to improve access to clean water and sanitation facilities?

d) How does your office support schools to strengthen WASH infrastructure and practices?

e) What criteria are used to identify which schools receive assistance or resources?

f) How do you coordinate with NGOs, development partners, and community organizations in delivering WASH support?

g) Have you observed any significant changes in pupil enrolment across sub-counties? What factors have contributed to these trends?

h) What policies or strategies are planned to address persistent WASH challenges?

APPENDIX V: Observation Checklist for Wash Facilities

School Name: _____

Zone: _____

Date of Observation: _____

Observer's Name: _____

3A. WATER SUPPLY

Item	Observed (✓/✗)	Comments
Functional water source present (e.g., tap, tank, borehole)		
Availability of clean, safe drinking water		
Rainwater harvesting system in place		
Buckets or containers with taps provided		
Location of water source is accessible to pupils		

3B. HANDWASHING FACILITIES

Item	Observed (✓/✗)	Comments
Presence of handwashing stations		
Stations located near toilets/dining areas		
Water available at handwashing stations		
Soap available for handwashing		
Handwashing posters/signage present		

3C. SANITATION FACILITIES

Item	Observed (✓/✗)	Comments
Gender-separated toilets		
Functioning latrines/toilets (usable and clean)		
Doors with locks for privacy		
Waste disposal bins available		
Toilets cleaned at least once daily		

3D. HYGIENE PROMOTION & MAINTENANCE

Item	Observed (✓/✗)	Comments
Health/WASH club activities visible (e.g., posters, schedules)		
Hygiene messages/posters displayed		
Designated staff or students assigned to monitor cleanliness		
Maintenance of water and sanitation facilities evident		

APPENDIX VI: Focus Group Discussion (Fgd) Guide

Study Title: Factors Affecting the Effectiveness of Water, Sanitation, and Hygiene (WASH) Practices in Public Primary Schools in Machakos County, Kenya

FGD Objectives:

The FGD aims to:

1. Explore perceptions about the availability and adequacy of water and sanitation facilities.

2. Understand hand hygiene practices and related challenges.

3. Examine individual socio-behavioral factors influencing WASH practices, including knowledge, attitudes, beliefs, and peer influence.

4. Identify contextual and institutional factors (school policies, environmental conditions, resource constraints) affecting the effectiveness of WASH practices.

5. Gather suggestions for improving WASH programs in public primary schools.

PARTICIPANT CATEGORIES:

- Teachers responsible for health and hygiene.

- Health club patrons or representatives.

- Pupil representatives (Classes 6–8).

FGD REQUIREMENTS:

- Number of Participants per Group: 7–10

- Duration: 60–90 minutes

- Facilitators: Moderator + Note-taker

- Recording: Audio recording with consent

FGD Introduction Script (to be read by Moderator):

"Good morning/afternoon. Thank you for taking the time to participate in this discussion. My name is Lynn Mwende , and with me is [Goerge Odunga]. We are here to learn about your experiences and opinions about water, sanitation, and hygiene practices in this school. Your thoughts will help us understand what is working well and what can be improved.

There are no right or wrong answers. We just want your honest views. Everything you share will be confidential. You can choose not to answer any question or leave at any time. With your permission, we would like to record this discussion to help us remember what you said. Is that okay?

Do you have any questions before we begin?"

FGD DISCUSSION GUIDE

Section A: Availability and Adequacy of Water and Sanitation Facilities

1. What types of water sources are available for drinking and handwashing in your school?

2. Is the water usually safe and consistently available?

3. What challenges do you face in keeping water available throughout the day?

4. How adequate are the toilet and handwashing facilities for the number of pupils?

5. What do you think about the cleanliness, privacy, and safety of these facilities?

Section B: Hand Hygiene Practices

6. When do pupils typically wash their hands during the school day?

7. Is soap always available at handwashing stations?

8. What factors help or discourage regular handwashing with soap?

9. How do teachers and school management encourage hand hygiene?

Section C: Socio-Behavioral Factors

10. How much do pupils know about the importance of handwashing and safe sanitation?

11. What attitudes or beliefs influence whether they practice good hygiene?

12. Are there any cultural or peer influences that affect hygiene behavior?

13. How do pupils learn about hygiene—through lessons, clubs, or role models?

Section D: Contextual and Institutional Factors

14. What policies or school rules support or hinder WASH practices?

15. How do funding and resources affect your ability to maintain clean facilities?

16. What role do parents or community organizations play in supporting hygiene and sanitation?

17. What environmental challenges (e.g., water scarcity, infrastructure) impact WASH effectiveness?

Section E: Recommendations

18. What suggestions do you have for improving water, sanitation, and hygiene in this school?

19. What kind of support or resources would help make these improvements possible?

20. Is there anything else you would like to share about WASH practices?

Closing Remarks:

"Thank you for sharing your ideas and experiences. Your contributions will help us better understand how to improve WASH practices in schools. If you think of anything else you'd like to add, you can let us know later."

Signature of Moderator: _____ Date: _____

Signature of Note-taker: _____ Date: _____

APPENDIX VII: Parental Permission for Children Participation in Focus Group Discussion (FGD)

Title: Factors Affecting the Effectiveness of Water, Sanitation, and Hygiene (WASH) Practices in Public Primary Schools in Machakos County, Kenya

Introduction

The purpose of this form is to provide you with as the parent of a prospective research study participant information that may affect your decision as to whether to let your child participate in this research study. The person performing the research will describe the study to you and answer all your questions. Read the information below and ask any questions you might have before deciding whether to give your permission for your child to take part. If you decide to let your child, be involved in this study, this form will be used to record your permission.

Purpose of the Study

If you agree, your child will be asked to participate in a research study about Water Sanitation and Hygiene (WASH) practices in school. The purpose of this study is to the researcher to partially fulfill the requirement of her master's degree at **Amref International University**. It will help the researcher to understand the sources of water in school and hygiene conditions in school among the pupils.

What is my child going to be asked to do?

If you allow your child to participate in this study, they will be asked to have a Focus Group Discussion (FGD) based on the knowledge and the situation of Water Sanitation and Hygiene (WASH) programs in their school and there will be more than 30 other pupils in this study.

What are the risks involved in this study?

There are no foreseeable risks to participating in this study.

What are the possible benefits of this study?

Your child will receive no direct benefit from participating in this study; however, the findings obtained in this study will help the school and society at large to improve on Water Sanitation and Hygiene (WASH) practices in schools and at home environment.

Does my child have to participate?

No, your child's participation in this study is voluntary. Your child may decline to participate or to withdraw from participation at any time. Withdrawal or refusing to participate will not affect their relationship with the researcher or the Amref International University in any way. You can agree to allow your child to be in the study now and change your mind later without any penalty.

What if my child does not want to participate?

In addition to your permission, your child must agree to participate in the study. If you child does not want to participate they will not be included in the study and there will be no penalty. If your child initially agrees to be in the study they can change their mind later without any penalty.

Will there be any compensation?

Neither you nor your child will receive any type of payment participating in this study.

How will your child's privacy and confidentiality be protected if s/he participates in this research study?

Your child's privacy and the confidentiality of his/her data will be protected by not including any personal information in the questionnaire. Personal information includes names or even the names of the parents. All the information gathered shall only be used for the purpose of achieving education requirements and to inform the larger community about Water Sanitation and Hygiene (WASH) practices in schools.

Whom to contact with questions about the study?

Prior, during or after your participation you can contact the researcher LYNN MTUKU at 0727843925 for any questions or if you feel that you have been harmed. This study has been reviewed and approved by The Amref International University Board of Research and Ethics.

Signature

You are deciding to allow your child to participate in this study. Your signature below indicates that you have read the information provided above and have decided to allow them to participate in the study. If you later decide that you wish to withdraw your permission for your child to participate in the study you may discontinue his or her participation at any time. You will be given a copy of this document.

_____

Printed Name of Child

_____ _____

Signature of Parent(s) or Legal Guardian Date

_____ _____

Signature of Investigator Date

APPENDIX VIII: Informed Consent for Study Participants

TITLE OF STUDY: FACTORS INFLUENCING WATER, SANITATION, AND HYGIENE (WASH) PRACTICES IN PUBLIC PRIMARY SCHOOLS IN MACHAKOS COUNTY, KENYA.

PRINCIPAL INVESTIGATOR

Name……

Phone……...

Email……...

PURPOSE AND OBJECTIVE OF THE STUDY

You are being asked to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. (Please read the following information carefully. Please ask the researcher if there is anything that is not clear or if you need more information.)

The purpose of this study is to satisfy partial fulfilment for the award of master's degree in public health. The study is purely for academic purposes.

The study objective to assess the factors influencing water, sanitation infrastructure, and hygiene practices in public primary schools in Machakos County, Kenya.

STUDY PROCEDURES

The study will not involve any experimental procedure

For the In-depth Interviews the researcher will ask the participants to allow for recording for referral for any missed information during note taking. The recorded information shall be disposed- off once the researcher has picked the required information. This is optional and will only take under the express consent of the participants.

RISKS

This study does not involve any risk. You may decline to answer any or all questions and you may terminate your involvement at any time if you choose.

BENEFITS

There will be no direct benefit gained from participating in this study.

CONFIDENTIALITY

Your responses to this [survey] will be anonymous. Please do not write any identifying information on your [survey]. OR for the purposes of this research study, your comments will not be anonymous. Every effort will be made by the researcher to preserve your confidentiality, including the following:

Participant data will be kept confidential except in cases where the researcher is legally obligated to report specific incidents. These incidents include, but may not be limited to, incidents of abuse and suicide risk.

CONTACT INFORMATION

If you have questions at any time about this study, or you experience adverse effects as the result of participating in this study, you may contact the researcher whose contact

information is provided on the first page. If you have questions regarding your rights as a research participant, or if problems arise which you do not feel you can discuss with the Primary Investigator, please contact the Institutional Review Board at 0727843925

VOLUNTARY PARTICIPATION

Your participation in this study is voluntary. It is up to you to decide whether to take part in this study. If you decide to take part in this study, you will be asked to sign a consent form. After you sign the consent form, you are still free to withdraw at any time and without giving a reason. Withdrawing from this study will not affect the relationship you have, if any, with the researcher. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed.

CONSENT

I have read, and I understand the information provided and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Participant's signature _____ Date _____

Investigator's signature _____ Date _____

APPENDIX IX: Minor (Participant) Assent Form

Project Title: Factors Affecting the Effectiveness of Water, Sanitation, and Hygiene (WASH) Practices in Public Primary Schools in Machakos County, Kenya

Investigator(s): LYNN MUTUKU

We are doing a research study about WASH practices in schools as a partial fulfilment of obtaining Master's Degree.

This research study is a way to learn more about WASH programs in your school.

At least 381 pupils will be participating in this research study with you.

If you decide that you want to be part of this study, you will be asked to fill a question with the help of a research assistant which will take you about an hour to complete.

This study bears no risk to any individual and participation in this study is voluntary and one is allowed to withdraw at any stage without victimization.

Not everyone who takes part in this study will benefit. A benefit means that something goodhappens to you. We think these benefits might be understanding how to manage WASH programs both in school and at home.

When we are finished with this study we will write a report about what was learned. This report will not include your name or that you were in the study.

You do not have to be in this study if you do not want to be. If you decide to stop after we begin, that's okay too. Your parents know about the study too.

If you decide you want to be in this study, please sign your name.

I ……, want to be in this research study.

_____ _____

(Signature/Thumb stamp) (Date)

APPENDIX :X Official Research License &Approval Letters for the Study

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 710018

Date of Issue: 16/March/2023

RESEARCH LICENSE

This is to Certify that Miss.. Lynn Mwende Mutuku of Amref International University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Machakos on the topic: FACTORS AFFECTING THE IMPLEMENTATION OF WASH PRACTICES IN PUBLIC PRIMARY SCHOOLS IN MACHAKOS COUNTY; KENYA for the period ending : 16/March/2024.

License No: NACOSTI/P/23/23889

710018

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

See overleaf for conditions

MINISTRY OF EDUCATION

Office of the Principal Secretary, State Department for Basic Education

Telegrams: "EDUCATION", Nairobi
Telephone: Nairobi 3318581
E-mail:ps@education.go.ke

PRINCIPAL SECRETARY
JOGOO HOUSE "B"
HARAMBEE AVENUE
P. O. BOX 30040
NAIROBI

When replying please quote

Ref.**No:MOE.HQS/3/6/85 Vol.II (57)** **DATE: 30th March, 2023**

Lynn Mwende Mutuku
Amref International University
P.O. Box 27691-00506
NAIROBI

RE: AUTHORITY TO CONDUCT A RESEARCH IN SELECTED SCHOOLS IN MACHAKOS COUNTY

Reference is made to your application dated **28th March, 2023** over the above-mentioned subject.

Your request to conduct research in selected schools in Machakos County is hereby granted on condition that the exercise will be carried out professionally.

A report on the exercise will be required on completion.

Dr. Belio R. Kipsang, CBS
PRINCIPAL SECRETARY

Copy to: County Director of Education- Machakos County

OFFICE OF THE PRESIDENT
MINISTRY OF INTERIOR AND NATIONAL ADMINISTRATION
STATE DEPARTMENT FOR INTERNAL SECURITY AND NATIONAL ADMINISTRATION

Telephone: 21009 and 21983 – 90100
Email Address: cc.machakos@interior.go.ke
Fax No. 044-21999
When replying please quote:

OFFICE OF THE COUNTY COMMISSIONER
P.O. Box 1 – 90100
MACHAKOS

REF: CC/ST/ ADM 5/9 VOL. IV /166

8TH May, 2023

All Deputy County Commissioners
MACHAKOS COUNTY

RE: RESEARCH AUTHORIZATION – MISS LYNN MWENDE MUTUKU

The National Commission for Science, Technology and Innovation has authorized the above mentioned Student from Amref International University, to carry out a research on ***"Factors Affecting the Implementation of Wash Practices in Public Primary Schools "*** *in* Machakos County-Kenya, for the period ending 16th March 2024.

Please be notified and accord her the necessary assistance.

COUNTY COMMISSIONER * P. O. Box 1, MACHAKOS * 08 MAY 2023

ANTHONY NYONGESA
FOR: COUNTY COMMISSIONER
MACHAKOS COUNTY

FORWARDED
SUB- COUNTY DIRECTOR OF EDUCATION
ATHI RIVER
P. O. Box 114 - 00204, ATHI RIVER
8/5/2023

REPUBLIC OF KENYA

MINISTRY OF EDUCATION
State Department of Early Learning & Basic Education

Telegrams: "**SCHOOLING**"Machakos
Telephone: Machakos
Fax: Machakos
Email – cdemachakos@yahoo.com
When replying please quote

OFFICE OF THE
COUNTY DIRECTOR OF EDUCATION
EDUCATION
P. O. BOX 2666 – 90100
MACHAKOS

MKS/ED/CDE/R/4/VOL.4/285

Date: 8th May, 2023

Ms. Lynn Mwende Mutuku
Amref International University
P.o Box 27691-00506
NAIROBI

RE: RESEARCH AUTHORIZATION

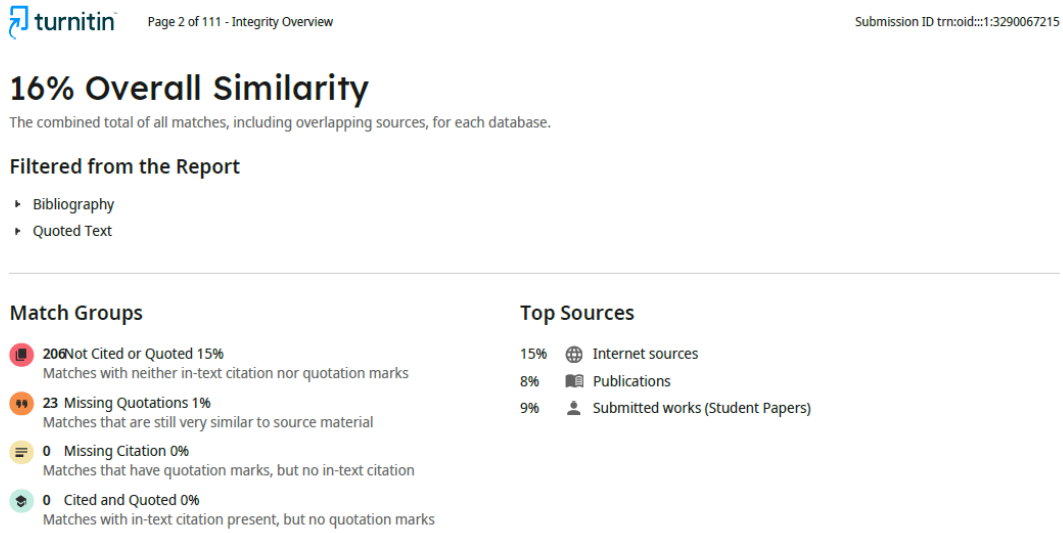
Reference is made to the letter from National Commission for Science, Technology and Innovation Ref: **NACOSTI/P/23/23889 dated 16th March 2023 .**You are hereby authorized to carry out your research on "**Factors affecting the implementation of wash practices in public Primary schools in Machakos County, Kenya"** for *a period ending **16th March, 2024.***

FOR COUNTY DIRECTOR
OF EDUCATION – MACHAKOS
Date: .....
MINISTRY OF EDUCATION
cdemachakos@yahoo.com

Dr. Samuel Bengi
FOR: COUNTY DIRECTOR OF EDUCATION
MACHAKOS.

SGS

APPENDIX XI: Similarity Report



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16% Overall Similarity

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Match Groups

206 Not Cited or Quoted 15%
Matches with neither in-text citation nor quotation marks

23 Missing Quotations 1%
Matches that are still very similar to source material

0 Missing Citation 0%
Matches that have quotation marks, but no in-text citation

0 Cited and Quoted 0%
Matches with in-text citation present, but no quotation marks

Top Sources

15% Internet sources
8% Publications
9% Submitted works (Student Papers)