



An investigation of the water conservation practices in three primary schools located in high water demand areas in Gauteng following a water conservation intervention.

Thesis submitted in fulfilment of the requirements for the degree
Master of Philosophy in Integrated Water Management at The
Independent Institute of Education, IIEMSA.

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31 / 01 / 2024

ABSTRACT

Rand Water's Water Wise Education Team (WWET) has been educating learners about water conservation and the practical ways to conserve water (Being Water Wise) for over 20 years as a measure to comply with the South African Water Services Act (108 of 1997), to promote water conservation and demand management, mainly for Gauteng as an area of supply. Rand Water has identified high water demand areas within their area of supply and has already invested in a water conservation intervention team, the WWET. The WWET's effectiveness towards water conservation practices and therefore water demand management as per Rand Water's mandate has not been investigated.

It is against this background that this study followed a qualitative interpretive design to investigate whether Rand Water's WWET's water conservation intervention programmes have achieved the desired outcome of improving water conservation practices in school learners located in high water demand areas within Rand Water's area of supply. Data was obtained through a series of pre and post surveys with learners and educators from three schools. The effectiveness was assessed through the use of questionnaires that included knowledge of best water use practices, water values and how learners react to water problems.

The findings indicate that the Water Wise Programme had an impact on refining water conservation perceptions and deepening understanding, especially among learners. However, the Water Wise Programme's influence on water conservation practices demonstrated through knowledge, skills, values, and practices were vague, showing challenges in translating knowledge into consistent behavioural changes. The study highlighted the need for follow-up initiatives that include practical applications of water conservation practices to close the gap between water conservation knowledge acquisition and the practical application as reinforcements to the interventions. Even though improvements were perceived in the management of water resources across the three schools, challenges in addressing prevalent issues like leaving taps running, and littering indicated a need for a more targeted intervention. Moreover, differences in the implementation of water conservation practices and reporting practices among learners indicated the importance of uniformity. Future studies would be required to investigate long-term impact, household-level implementation, and conceptual understanding of water-related concepts. The findings contributed valuable insights for improving water conservation initiatives in educational settings, highlighting region-specific considerations and continuous capacity building for educators.

Keywords: Rand Water, School learners, Water conservation interventions, Water conservation practices

DECLARATION

I, Sizwe Mndawe, declare that this thesis, titled "**An investigation of the water conservation practices in three primary schools located in high water demand areas in Gauteng following water conservation interventions**," is my own work. I affirm that:

The work presented in this thesis is original and has been carried out by me under the guidance of my supervisor.

All sources used or referred to in this thesis are duly acknowledged, and any assistance received in the preparation of the thesis has been acknowledged.

I have not presented this thesis or any part of it for any other academic qualification.

I am fully aware of the obligations of academic integrity and have followed the guidelines and ethical considerations in conducting and presenting my research.

All data, figures, images, and other content used in this thesis are appropriately cited and referenced.

The thesis follows the guidelines and regulations of IIE MSA.

Any views or opinions presented in this thesis are solely those of the author and do not necessarily represent the views of IIE MSA.

I understand that any breach of the above declaration may result in disciplinary action.

Date: 30 January 2024

Signature: _____

Sizwe Mndawe

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to the following individuals and institutions who played a significant role in the completion of this research thesis:

I am grateful to Linda Downsborough, my supervisor, for her helpful direction, persistent support, and insightful input throughout the study process. Her knowledge and support helped shape the direction and quality of this thesis.

I would like to thank the IIE MSA's academic advisory committee for their constructive criticism, helpful recommendations, and dedication to academic success. Their united expertise has enhanced the scholarly content of this work.

I am grateful to Dr Cheryl Ogilvie, PHD Candidate Maria Pooe and Faith Chauke (Mabunda) for their collaboration and contributions to specific aspects of this research. Their combined insights and coordinated efforts have significantly increased the depth of this study.

To my family, the late Gogo Mzi and Mkhulu Mndawe, my lovely mother Phindile Mndawe, my son Khanya Mndawe and Mama Khosi whose unwavering support and understanding have sustained me throughout this challenging journey, I extend my deepest gratitude. Your encouragement, prayers and patience have been a source of inspiration and strength.

I would like to show gratitude to my peers and colleagues Themba Nkuna and Tumi Nissel for their camaraderie, intellectual exchange, and moral support. Our discussions and shared experiences have enriched my academic and personal growth.

I am grateful to Rand Water for providing the necessary environment, resources, facilities, and academic environment conducive to research and learning for its employees. The Water Wise Education Team for allowing me to conduct this research on their interventions. The Department of Education, Education Research and Knowledge Management section for approving this research. The participating three primary schools in which the research was conducted. located

In conclusion, the completion of this thesis would not have been feasible without the collaborative efforts of these individuals and institutions. While any omissions are unintentional, I express my deepest appreciation to all those who have been a part of this academic endeavour.

To my God, you are faithful, even today. To God be the glory, forever and ever Amen!

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LIST OF ACRONYMS

BRICS	Brazil, Russia, India, China, and South Africa
CAPS	Curriculum and Assessment Policy Statement.
E.E	Environmental Education.
IEB	Independent Examinations Board.
NGO	Non-Governmental organization.
SEM	Social Ecological Model (SEM).
SES	Socio-Ecological Systems.
WUEI	Water Use Efficiency Index Map.
WWET	Water Wise Education Team.

CHAPTER 1: CONTEXT

1 Introduction

Water is the source of life, a valuable natural resource which human beings cannot survive without (DSS, 2010). Access to safe drinking water is a fundamental human right (Corcoran, 2010). Water conservation refers to any actions taken to preserve the hydrosphere, responsibly manage freshwater resources, and meet current and future population demand (Baliant, 1999). The amount of water used is determined by a variety of factors, including population, household size and growth, and wealth. Climate change has also increased the demand for natural water resources, particularly for activities such as energy production by industries and agricultural irrigation. Hodges *et al.* (2020) identified the following as the primary activities for water conservation: any beneficial reduction in water loss, use, and resource waste; preventing any damage to water quality; and developing water management methods that minimise or promote the beneficial use of water. According to Gilmore *et al.* (2019) technological solutions are available for usage in domestic, professional, and agricultural settings. Municipal water utilities or regional governments typically launch water conservation programmes that address social issues at the local level.

According to Hodges *et al.* (2020) South Africa has seen an increase in reports of possible water scarcity which can ultimately result in increased diseases and famine. Therefore, it is important for the country to implement sound water conservation measures which can aid in water demand management. A water shortage arises when there is insufficient water supply to meet average water demand (Robson, 2017). This means that the economy still lacks substantial capital to improve their infrastructure. Economic water conservation refers to the protection of infrastructure that is used to provide clean water sources (Westhorp, 2014). The National Water Resource Strategy (NWRS-3) acknowledges the need to invest in water conservation, sanitation, and demand management. The strategy also emphasises consumer responsibility and end-user education as important guiding principles for South African water and sanitation services. The right to adequate water and sanitation services involves the responsibility to use it effectively and with responsibility.

The National Water Conservation and Water Demand Management Strategy (NWC/WDMS) is another step in promoting water as an important but limited resource that should be intrinsically valued.

Rand Water is a bulk potable water supplier to over 12 million people in South Africa, with customers including local governments such as metropolitans, mines, and industries, and it distributes an average of 3 653 megalitres per day of water to customers (Kumari & Singh, 2017). Rand Water is mandated by (Section 4.2.c. (vi)) of the South African Water Services Act (108 of 1997) to promote water conservation and demand management. To respond to the mandate, Rand Water introduced the environmental brand, Water Wise and within Water Wise, the Water Wise Education Team (WWET) with a function to facilitate educational water conservation interventions to customers mainly learners, students, and educators in the Gauteng province. It was important for WWET interventions to be introduced to ensure that communities are taught the importance of water conservation. The water conservation programmes target school children as they are the future of South Africa (Bellittini, 2005). It is assumed that children are future adults and should know why they should save water and be aware of the methods that can be implemented to save water.

Popular programmes offered by the WWET, are the: (1) Water purification experiment which is aimed at teaching learners about the water purification and supply process with the expectation that if learners know where water comes from they will conserve it. (2) Manzi's Water Wise Roadshow which is focused on teaching learners about the six meanings of being water wise (Respect Water- Respect Life, Don't Waste Water, Don't Pollute Water, Pay for Water Services, Take Environmental Action and Conserving Water- Conserving the Environment) which is aimed at encouraging the learners to practice water conservation. (3) How to change a washer, the participants are taught how to reduce water loss from a dripping tap by simply changing the tap washer.

These interventions are expected to create a positive outcome on the learner's attitudes and behaviour in best practices towards water conservation. The term "impact" refers to the positive or negative changes caused by a development intervention, whether direct or indirect, intentional, or unintended, in the context of its environment as it interacts with the various components influencing developmental change (Westhorp, 2014). As an operational definition in this

study, the impacts will be observed as positive and negative changes towards water conservation practices that will come about after the WWET intervention.

Currently the interventions have an evaluation tool which is completed at the end of each programme by the programme participants, however, these evaluations only measure the relevance of the programmes to the current Curriculum and Assessment Policy Statement (CAPS) school curriculum and not Rand Water's water conservation and demand management mandate. This research study will be focusing on these WWET intervention programmes and how they impact the water conservation practices of the learners in three schools within Gauteng.

1.1 Problem Statement

Rand Water's WWET has been educating learners about water conservation and ways to practically conserve water (Being Water Wise) for over 20 years as a measure to comply with the South African Water Services Act (108 of 1997) mainly for Gauteng as an area of supply. In addition to this, Rand Water has produced a GIS map (Figure 1.1.a) called the Water Use Efficiency Index Map (WUEI), which highlights high water demand areas that need water conservation intervention initiatives. The map depicts different levels of water efficiency or consumption, highlighting places with higher or lower water efficiency. These indexes can be used to identify areas for improvement, execute conservation measures, and address water management challenges.

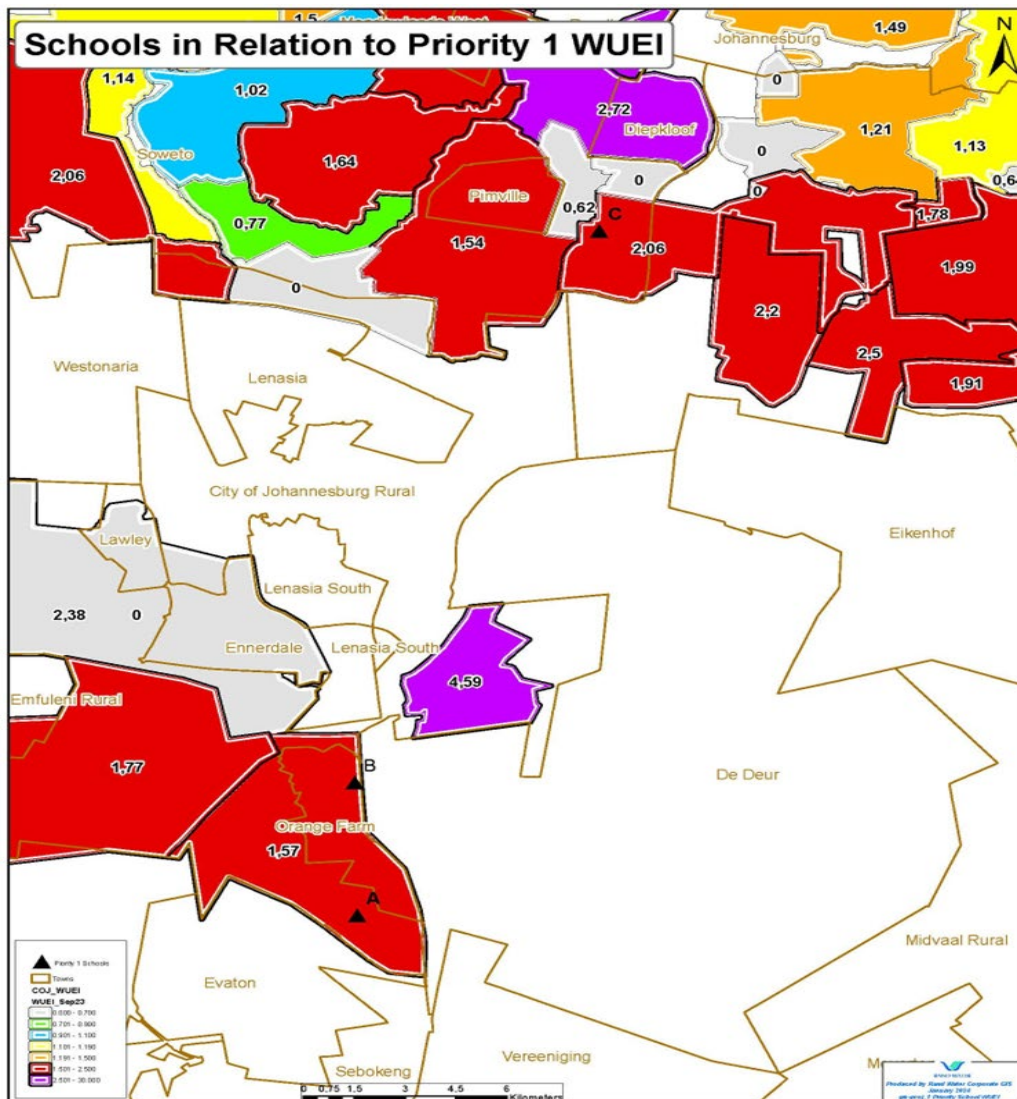


Figure 1.1.a: The Water Use Efficiency Index Map showing schools that are within high water demand areas highlighted in red (Rand Water GIS, 2024).



Figure 1.1.b The WUEI Map legend.

The areas are colour coded according to the average water usage per household as an example in the red areas the average water usage is 1501 to 2500 litres/day , which indicates a high water usage within the area. Figure 1.1.b highlights a better view of the legend of the WUEI map.

Vickers (2001) highlights that conservation initiatives need to have an impact that will lead people to practical water conservation in their day to day lives. According

to Still *et al.* (2008) impact looks at how the world would be after a possible intervention, it can be two-fold, that is impacts can be seen as positive and negative outcomes that come about after an intervention such as the WWET intervention.

Rand Water has identified high water demand areas within their area of supply and has invested in a water conservation initiative intervention team, which is the WWET. The WWET's effectiveness towards water conservation practices and therefore water demand management as per Rand Water's mandate has not been evaluated and thus created an opportunity for this study. Current WWET assessment tools measure the Curriculum and Assessment Policy Statement (CAPS) curriculum alignment, audibility of the WWET presenter, cleanliness of the resources used in the programme, but does not measure the impact of the intervention programme to the customer (learner). CAPS is a comprehensive framework that specifies the curriculum and assessment criteria for schooling from Grade R through Grade 12 in South African public schools to standardise education and provide consistency in teaching and learning (Ajani, 2021).

The study used the Social Ecological Model (SEM) which is a model adapted from the Social Ecological System's theory which is a framework that is used to understand the complex interactions between individuals and their environments (Gunckel *et al.*, 2012). The SEM suggests that changes or interventions at one level can have ripple effects across other levels (Partelow, 2018). From the Individual Level, which encompasses an individual's distinctive traits such as knowledge, attitudes, and behaviours, to the Interpersonal Level, which covers relationships and interactions with family, friends, and peers. It examines how these interactions influence a person's behaviour and choices. This level is made up of communities and neighbourhoods. Institutional Level: Organisations and institutions such as schools are included in this level. At this level, policies, rules, and regulations influence behaviours and practices. The most general level includes Societal Level: which looks at cultural values, economic policies, media, and political systems (Partelow, 2018). This is the main framework that was used to understand how the participant's attitudes and behaviours towards water conservation in schools are heavily influenced by their social networks. (Figure 2.1).

1.2 Research Aim

The aim of this study was to determine whether Rand Water's Water Wise Education Team's water conservation intervention programmes have achieved the desired outcomes of improving water conservation practices in learners in schools located in high water demand areas within Rand Water's area of supply.

1.3 Primary research question

- What are the positive or negative changes in water conservation practices in school learners as a result of Rand Water's Water Wise Education intervention programmes?

1.4 Secondary research questions

- Does the Water Wise intervention instil water conservation knowledge on Primary school learners located within a high-water demand area?
- Does the Water Wise intervention impart water conservation skill to Primary school learners located within a high-water demand area?
- What sound water conservation practices have the learners adopted post the WWET intervention?
- Do the educators observe a change in water conservation practices at the school post the WWET intervention?
- To what extent is the information taught by the WWET relevant to the learners in teaching best practices for water conservation?
- Is there a change in the school's Water bill post the intervention?

1.5 Thesis outline

1. **Chapter 1-** The current chapter introduces the study, including the problem statement, the significance of the study, and the research aim with associated research question..
2. **Chapter 2-** Presents relevant literature for the study. This portion was sourced from already established literature on the subject within and outside South Africa. The main concepts of water conservation, water scarcity and impact of training interventions are covered.

3. **Chapter 3-** Presents the research design and methodology that was used for the study, the research philosophy or approach which drove the research design, and the methods and instruments employed for the research.
4. **Chapter 4-** Presents the findings from the research process which includes the structured observations and questionnaires.
5. **Chapter 5-** Discusses the conclusions and recommendations drawn from the data findings and recommend areas for future study.
6. **Chapter 6 -** summarises the main findings from the study and provides a conclusion for the study.

1.7 Conclusion

This chapter provided a brief overview and outline of the research. The aim of the research was to determine whether Rand Water's Water Wise Education Team's water conservation interventions programmes have achieved the desired outcomes of improving water conservation practices in learners in schools located in high water demand areas within Rand Water's area of supply. Due to the complex nature of the study, an Interpretivists approach which is a qualitative method of design was adopted by the researcher as it aids in filling in gaps and explanatory accounts which essentially involves the use of social factors to collect data. The chapter also provided the questions the research will answer; the questions were generated from the aims of the study.

CHAPTER 2: LITERATURE REVIEW

2 Introduction

This purpose of this chapter is to provide an overview of water scarcity in high demand areas, describe the importance of water conservation practices within schools and provide a comprehensive exploration of water conservation practices in primary schools, taking a multi-dimensional approach. It explores the global, regional (African context), and local (South African) perspectives, with the objective to highlight perspectives from different contexts and approaches toward water conservation initiatives within educational settings. The chapter synthesised a wide range of scholarly sources, with the aim of portraying a comprehensive picture of water conservation practices in primary schools. In addition, the chapter describes how the Social-Ecological Model (SEM) was applied to serve as a lens to dissect the intricate layers of individual, interpersonal, organisational, community, policy and societal factors influencing water conservation behaviours within the educational settings.

2.1 Overview of water scarcity in high demand areas

According to Boretti and Rosa (2019), water scarcity is a critical global problem, predominantly impacting high demand areas where population growth and urbanisation strain have already limited water resources. Booysen and Gerber (2021) note that primary schools are among the key institutions affected by water scarcity, and they play an indispensable role in shaping young minds and communities. Within the South African context, the challenge of water scarcity is quite evident in Gauteng (Ripunda, 2019). The Gauteng Province is grappling with a juxtaposition of high-water demand and limited supply posing serious challenges for schools in ensuring adequate water access and encouraging responsible water usage (Ripunda, 2019). The scarcity of water in the Gauteng region arises from a multitude of factors, including rapid urbanisation (Kotzé, 2020), ineffective water management practices (Hara *et al.*, 2021), climate change effect on rainfall patterns (Steyn *et al.*, 2019), and insufficient infrastructure for storage and distribution of water (Kotzé, 2020). As a result, water scarcity has led to increased competition for available water resources among different sectors, including domestic, agricultural, and industrial, worsening the strain on already constrained water supplies (Bischoff-Mattson *et al.*, 2020). Primary schools, as fundamental parts of the impacted communities, stand as

crucial centres for promoting water conservation practices and, facilitating a comprehensive understanding of the local water scarcity context to implement effective and sustainable conservation initiatives (Valenzuela-Morales *et al.*, 2022).

2.1.2 Importance of water conservation in schools

Water conservation practices within schools particularly those that are located within high water demand areas are of paramount importance in ensuring sustainable resource management and encouraging environmentally conscious behaviour among the younger generation (EL-Nwsany *et al.*, 2019). Schools serve as pivotal environments to promote awareness, habits, and practices that can significantly impact people's water consumption patterns. Integrating water conservation into the curriculum and daily operations, enables schools to not only address the immediate challenge of water scarcity but also encourage a culture of environmental responsibility among the learners, educators, and communities (Thiam *et al.*, 2021). Furthermore, educating people at an early age about water-saving practices can catalyse behavioural changes and build a generation attuned to the significance of preserving natural resources (EL-Nwsany *et al.*, 2019). Therefore, exploring and understanding the water conservation initiatives within primary schools located in high-demand areas like the Gauteng region can provide valuable perspectives into effectiveness of existing initiatives, challenges faced, and potential avenues for improving water-saving initiatives at different levels within the society.

2.2 Global perspective on water conservation in schools

According to Ardoin *et al.* (2020) the implementation of water conservation initiatives within schools across water-scarce regions globally has shown both successes and challenges. Successes are especially observed in cases where comprehensive water-saving initiatives have been integrated into school infrastructure and educational curricula (Miller *et al.*, 2014; Amahmid *et al.*, 2019). For an example, Middlestadt *et al.* (2001) examined the impact of using interactive teaching methods to promote conservation behaviours among learners and their families in Jordan. It was reported that learners who were exposed to the new curriculum showed a higher level of knowledge about water conservation and performed recommended behaviours more often than the learners in the control group. Valenzuela-Morales (2022) recently implemented an environmental

education programme on water conservation among 10-year-old learners from two rural communities in Mexico. The study reported that learners who participated in the educational programme improved their knowledge, attitudes, and perception towards water. Morote *et al.* (2020) examined initiatives aimed at environmental education and saving water in Spanish schools and reported that educational initiatives promoting water-conscious behaviours among the learners and staff have proven effective in promoting a culture of water conservation. Moreover, partnerships with local communities or community-based organisations can facilitate the sharing of best practices, establishing a broader impact beyond the school environment (Rojas *et al.*, 2020). Nevertheless, challenges still exist, often premised on financial constraints, limited access to recent technology, or lack of policy support. The sustainability of water conservation initiatives is often affected by inconsistent maintenance practices and lack of ongoing monitoring, which may undermine the long-term effectiveness of implemented initiatives (Ardoin *et al.*, 2020). According to Tadaki *et al.* (2020) addressing the challenges associated with water conservation initiatives requires collaborative efforts among stakeholders, including governments, educational institutions, and local communities, to overcome difficulties and guarantee the sustained success of water conservation initiatives in schools across the globe.

2.2.1 Water conservation practices within the BRICS countries

The BRICS countries (Brazil, Russia, India, China, and South Africa) as a group represent a significant portion comprising of 41% of the world population of the world's population and economy (Roberts *et al.*, 2018). Exploring water conservation practices within the BRICS countries is highly relevant to this study as these countries provide different approaches, lessons, and experiences in managing water resources in different socio-economic contexts (Singh *et al.*, 2020; Likhacheva *et al.*, 2021). Lessons learned from BRICS countries' approaches can offer valuable perspectives and potential solutions applicable to South Africa's high-demand areas (Likhacheva, 2019). A comparative analysis with these countries can widen perspectives, offering innovative ideas, best practices, and policy recommendations for effective water conservation in particularly in schools in Gauteng Province. The following sections provide a comprehensive discussion on water conservation practices within the BRICS countries and their relevance to the study of water conservation in high-demand areas such as the Gauteng Province.

2.2.1.1 Water conservation practices in Brazil

Brazil is a country which struggles with complex water management challenges stemming from both abundance and scarcity issues (Voumik and Sultana, 2022). Regardless of its vast water resources, Brazil faces uneven distribution and increasing demand due to rapid urbanisation and climate change (Mota, 2022). According to Schultt (2022), water conservation practices in Brazilian schools are premised on sustainable water use through multifaceted approaches. Rainwater harvesting systems are becoming increasingly prevalent, specifically in schools, assisting in lowering the demand of water from municipalities (Antunes and Ghisi, 2020). Nunes *et al.* (2019) reported on educational programmes within schools focusing on environmental awareness and the importance of water conservation, integrating these lessons into the curriculum to encourage responsible water habits among learners. Additionally, Brazil has implemented policies and initiatives supporting efficient irrigation systems, water recycling, and community engagement initiatives to promote a culture of conservation beyond the school environment (de Sousa and Kreutz, 2023). These efforts underscore Brazil's commitment to conserving its water resources, offering valuable perspectives and lessons relevant to regions facing similar challenges, like Gauteng in South Africa, regarding water scarcity and conservation initiatives within schools.

2.2.1.2 Water conservation practices in Russia

Russia, with its vast landmass and significant water resources, faces challenges predominantly based on maintaining water quality rather than scarcity (Shumilova *et al.*, 2023). Russia's water conservation initiatives pivot on guaranteeing efficient use, specifically in urban areas and industries, to avoid pollution and wastage (Proskuryakova and Sivaev, 2020a). Schools play a crucial role in Russia's conservation landscape, incorporating environmental education that involves water preservation practices and aligning with the country's broader commitment to sustainable development (Yvonne, 2012). Educational initiatives focus on establishing an understanding of the value of water resources among learners, highlighting responsible consumption behaviour and the significance of preserving natural ecosystems (Kriukova *et al.*, 2020). Russia's emphasis on water management extends beyond conservation, including comprehensive policies and regulations to monitor and maintain water quality standards,

indicating the nation's commitment to protecting its abundant water resources for current and future generations (Proskuryakova and Sivaev, 2020b).

2.2.1.3 Water conservation practices in India

In India, water conservation initiatives are imperative due to the country's varied climatic conditions and increasing water scarcity in different regions (Pani *et al.*, 2021). With a population of approximately one billion people, the demand for water continues to rise (Manju and Sagar, 2017). Schools in India are actively involved in water conservation practices, implementing initiatives such as rainwater harvesting systems, water recycling, and efficient irrigation systems on school premises (Alexandar and Poyyamoli, 2012; Holland-Stergar, 2018, Krishna *et al.*, 2020). According to Krishna *et al.* (2020), educational initiatives play a significant role in instilling water-saving behaviours among learners, incorporating environmental education into curricula to highlight the importance of water conservation. The Indian government has rolled out policies and initiatives premised on water conservation, including the Jal Shakti Abhiyan (Vyas and Nath, 2021), the aim of this water conservation campaign is to rejuvenate water resources and promote water conservation practices across communities, as well as schools (Wanti, 2023). Despite such initiatives, India faces serious challenges, including water pollution, inefficient agricultural systems, and disparities in access to clean water, highlighting the urgency to further reinforce conservation initiatives, particularly in regions struggling with water scarcity (Kumar *et al.*, 2021), reflecting the challenges faced in high-demand areas like Gauteng Province in South Africa. The multifaceted approach in India's water conservation initiatives, which include technological solutions, education, and policies, offers valuable perspectives and potential initiatives for similar contexts across the globe, significantly contributing to the comparative analysis of water conservation practices in primary schools in South Africa's high water demand areas.

2.2.1.4 Water conservation practices in China

The approach used by China towards water conservation reflects the nation's growing concerns over water scarcity amidst rapid industrialisation and urbanisation (Shi *et al.*, 2022). Facing considerable water scarcity, China has implemented multifaceted initiatives premised on conservation, technological advancement, and policy reforms (Song *et al.*, 2018). Water-saving systems, for example drip irrigation and water-efficient equipment, have been widely adopted

across different sectors, including schools, with the aim of reducing consumption and increase efficiency (Xiong *et al.*, 2016; Zhan *et al.*, 2019). Furthermore, China has implemented strict regulations and changed the pricing system to incentivize water conservation behaviours (Zhang and Oki, 2023). Educational programmes in schools focus on environmental awareness, including the significance of water conservation, integrating it into curricula to instil sustainable behaviours among learners and communities. According to Zhao *et al.* (2017), the Chinese government's commitment to large-scale water infrastructure projects, for instance the South-to-North Water Diversion Project, shows efforts to address regional disproportions in water availability. Even though China has made significant improvements, challenges still exist, including water pollution, unequal distribution, and the need for continuous investment in infrastructure and education. However, China's comprehensive approach to water conservation, technological advancement, and policy initiatives serves as a compelling case study providing valuable perspectives relevant to addressing water scarcity in high-demand areas within the South African context.

2.3 Water Conservation Initiatives in Africa

Within the African continent, water conservation initiatives differ significantly due to the continent's different geographical and socio-economic landscapes (Nyamekye *et al.*, 2018; Leal Filho *et al.*, 2022). Several regions struggle with acute water scarcity, strengthening the need and significance of conservation initiatives (Leal Filho *et al.*, 2022). Across the continent, several initiatives and policies have been established to address water conservation in educational settings, including schools. These initiatives range from educational campaigns promoting awareness about water scarcity and conservation practices to the implementation of practical methods for example water-efficient infrastructure, rainwater harvesting, and community engagement initiatives (Fisher-Jeffes *et al.*, 2018; Moglia *et al.*, 2018; Olivier and Xu, 2019). Countries facing serious water challenges, for example South Africa, Kenya, and Ethiopia, have increasingly highlighted water conservation within schools as part of general national strategies (Nhamo *et al.*, 2019; Thakur *et al.*, 2020). Furthermore, collaborations with NGOs, international organisations, and local communities play a fundamental role in implementing effective water conservation initiatives, aiming to guarantee sustainable access to water resources for schools and communities across Africa

(Pesanayi and Weaver, 2016). However, despite these initiatives, persistent challenges for example inadequate funding, infrastructure limitations, and the impact of climate change requires continued innovation, collaboration, and policy support to strengthen water conservation initiatives in African schools (Nyamekye *et al.*, 2018) particularly those within high water-demand areas.

2.3.1 Water conservation efforts in schools across Africa

In the African continent, schools have been instrumental in spearheading water conservation initiatives, identifying the significance of preserving water resources in regions frequently impacted by water scarcity. Initiatives include different strategies, such as the installation of water-efficient infrastructure like low-flow taps, toilets, and rainwater harvesting systems (Fisher-Jeffes *et al.*, 2018; Moglia *et al.*, 2018; Olivier and Xu, 2019), designed to suit the specific needs and conditions of diverse regions. Educational programmes and curricula integrate topics on water conservation, engaging learners in practical activities that promote sustainable water conservation practices and foster a sense of environmental stewardship. Additionally, collaborations between schools, local communities, NGOs, and governmental bodies have fostered initiatives, enabling the sharing of knowledge, resources, and best practices in water conservation (Onyenankeya and Salawu, 2018). Despite these developments, challenges for instance limited funding, inadequate infrastructure, and irregular water supply persist in many African schools, highlighting the need for continued support, investment, and innovative solutions to guarantee sustained water conservation initiatives in schools across the continent (Mango *et al.*, 2017).

2.3.2 Policies and programmes supporting water conservation within the African region.

Policies and programmes supporting water conservation within the African continent have changed over time to address the critical need for sustainable water management amidst the ongoing challenges of water scarcity. The African Union's Agenda 2063 and Sustainable Development Goals (SDGs) have emphasised the importance of water conservation, leading to the development of regional frameworks and initiatives (Mutagamba, 2008; Mutschinski and Coles 2021). According to Mutschinski and Coles (2021), the African Ministers' Council on Water (AMCOW) has played a crucial role, advocating for policies that underscore integrated water resource management, encouraging efficient water

use, and improving access to safe drinking water and sanitation. Several African countries have developed national policies and strategies tailored to meet their respective water challenges, integrating elements for instance water pricing systems, water allocation systems, and regulations for water quality standards (Nyamekye *et al.*, 2018). Moreover, transboundary collaboration agreements among African nations have aimed to promote collaborative approaches for managing common water resources sustainably (Reij *et al.*, 2013; Hirwa *et al.*, 2022). These policies and strategies highlight the collective obligation toward addressing water conservation on a regional scale, recognising its crucial role in guaranteeing water security and advocating for socio-economic development across the continent (Reij *et al.*, 2013). The following sections provides an overview of some policies, Acts and programmes that have been implemented within the African context. These policies Acts and programmes indicate dedication of African countries to address water conservation through legislative frameworks that highlight sustainable management, efficient use, and the protection of water resources for future generations.

The South African National Water Act (Act 36 of 1998). This act provides a framework for managing water resources in a sustainable and equitable manner. It promotes the efficient, beneficial use of water, while also protecting and conserving water resources. The legislation underscores water conservation and demand management, compelling water users to implement measures to reduce wastage and increase water efficiency (Republic of South Africa, 1998).

The Kenyan Water Act (No. 43 of 2016). This legislation establishes a framework for the sustainable and equitable management of water resources. It underscores integrated water resources management, supporting conservation initiatives, water quality protection, and efficient water use (Ominde, 2019). Muigua (2020), adds that this legislation promotes community participation in the management of water resources and requires the preparation of water conservation plans.

The Nigerian National Water Resources Policy (2004). According to Enyidi (2017) the Nigeria's National Water Resources Policy aims to ensure sustainable water resources management by promoting conservation, efficient use, and equitable distribution of water. Ngene *et al.* (2022) described the policy as focused on the integration of water conservation practices into different sectors, including

agriculture, industry, and domestic use. In addition, the policy addresses issues of preventing pollution and protecting the environment (Makanda *et al.*, 2022).

The Ethiopian Water Sector Development Programme (WSDP). The WSDP is premised on the sustainable development, conservation, and management of water resources in Ethiopia (Moges, 2022). It includes initiatives to enhance water supply and sanitation services while highlighting the conservation of water through effective use, catchment protection, and the development of water infrastructure (Moges, 2022).

2.3.3 Challenges faced and lessons learned within the African region.

Across the African continent, several challenges that impede comprehensive water conservation initiatives, have been reported. These include limited access to clean water, ineffective infrastructure, climate-induced water scarcity, and rapid population growth. Some challenges emanate from insufficient funding, weak institutional capacity, and competing water needs across sectors. Muigua (2020) states that the need for comprehensive methods to water conservation that incorporate laws that support responsible water use, community involvement, and infrastructure development is highlighted by the lessons learnt from these difficulties. The implementation of successful water conservation policies has been attributed to cooperation between governments, local communities, non-governmental organisations, and international organisations. Moreover, it has become clear that a key component of ongoing water conservation initiatives is stressing education and awareness campaigns that foster a culture of responsible water use from a young age. Embracing cutting-edge technologies customized for regional conditions and encouraging cross-border collaboration are two more lessons discovered to address the obstacles associated with water conservation throughout the varying environments of Africa.

2.3.3.1 Water conservation practices in South Africa

The National Development Plan (NDP) of South Africa acknowledges water scarcity as a significant challenge that poses risks to socio-economic development, environmental sustainability, and human well-being (South Africa. National Planning Commission, 2012). Gauteng primary schools, like others across the country, have embraced a variety of strategies to address water conservation. In order to reduce water waste, these initiatives entail the

installation of water-saving technologies including low-flow fixtures, greywater recycling systems, and infrastructure for collecting rainwater. Water conservation projects inside schools play a critical role in instilling knowledge and behavioural changes among students, instructors, and the greater community. Furthermore, laws and regulations that support wise water use and conservation measures have been implemented in South Africa. In spite of these efforts, the nation still faces difficulties as a result of recurring droughts, outdated water infrastructure, and unequal access to water resources. To manage water use in schools and high-demand regions like Gauteng sustainably, the nation needs to continuously innovate, engage the community, and practice effective governance.

2.3.3.2 Legal, Policy and strategic frameworks supporting water conservation practices in South Africa

The legal framework in South Africa encompasses water management, conservation, and sustainability, all of which are important aspects of water conservation (National Water Act, 1998, National Environmental Management and Biodiversity Act, 2004). South Africa's legal framework for water conservation initiatives is primarily composed of the following elements:

National Water Act (No. 36 of 1998): This Act serves as the foundation for South African water resource management. It creates a framework for the nation's water resources' usage, conservation, development, management, and control. The Act, which includes rules for demand management and water conservation, highlights the necessity of sustainable and efficient water use.

Water Services Act (No. 108 of 1997): This Act aims to ensure that all South Africans have access to water services. It defines water service authorities' obligations and sets standards for the efficient and sustainable use of water resources, including provisions for water conservation and demand management at the local level (Water Services Act, 1997).

National Environmental Management: Biodiversity Act (No. 10 of 2004): Although not exclusively concerned with water, this Act contributes to biodiversity and ecosystem preservation, which has an indirect effect on efforts to save water by safeguarding ecosystems that are vital to water availability and quality (National Environmental Management, 2004).

National Development Plan (NDP): The NDP for South Africa has policies and objectives for conserving and managing water resources. In order to promote sustainable development, it highlights how crucial it is to guarantee water security, enhance water quality, and put into practice efficient water conservation measures. The NDP emphasises the significance of raising public awareness about water scarcity, its causes, and probable resolutions. The NDP moreover highlights the need for educational campaigns, community outreach programs, and stakeholder engagement initiatives to promote water conservation, sustainable water management practices, and responsible water stewardship among individuals, communities, and businesses. (South Africa. National Planning Commission, 2012).

Water Conservation and Demand Management Strategies (WC/WDM): In accordance with the National Water Act, water authorities at the National, provincial, and local levels create these strategies. They provide detailed instructions on how to properly manage water demand, minimise water loss, and conserve water. The NWC/WDMS is another step in which South Africa is promoting water as an important but limited resource that should be intrinsically valued, however, the NWC/WDMS has recognised the baseline and status quo of water and sanitation literacy and awareness as extremely poor among the general public, resulting in inefficient water usage and wastage, as well as unhealthy sanitation behaviours. (Water Research Commission, 2004).

The National Water Resource Strategy (2023): The NWRS- 3 recognises the need to invest in water conservation, sanitation and water demand management. The strategy also identifies consumer responsibility and end user education as some of the key guiding principles for water and sanitation services in South Africa. The right to adequate water and sanitation services includes the responsibility to utilize it appropriately and with care. (The Department of Water and Sanitation, 2023).

Institutional Framework: Alongside legal provisions, there are institutions like the Department of Water and Sanitation (DWS) which is responsible for implementing, monitoring, and enforcing water-related laws and policies.

Community Participation and Stakeholder Involvement: In addition, the NWA as a legal framework has some sections that promote stakeholder and community involvement in water conservation initiatives. Section 27 addresses the development and implementation of water conservation and demand

management strategies at various levels of governance. It requires water services authorities to promote water conservation practices among consumers and to implement measures to reduce water wastage, supported by Section 39 addresses the need to raise public awareness and education about water-related concerns such as water conservation and sustainable water use practices. It empowers the Minister of Water Affairs to create programs and activities targeted at raising public awareness of water resource management and encouraging responsible water stewardship.

South Africa's diverse legal system demonstrates a dedication to encouraging water conservation, guaranteeing the sustainable use of available water resources, and tackling the problems brought on by dwindling supplies and rising demand.

2.4 Theoretical framework for understanding water conservation practices.

The SES theory, proposed by Bronfenbrenner (1979), will be adopted as the foundational theoretical framework for this study. This conceptual framework, as applied in this study, acknowledges the intricate nature of human development. It recognises that different interconnected factors at different levels play a role in shaping the developmental process (Evans, 2020). The SES theory underscores the importance of comprehending the interrelationships among social, economic, and environmental dimensions to understand an individual's development (Bronfenbrenner, 1979). The application of the SES theory to this study is visually represented in Figure 2.4, illustrating the distinct levels within the socio-ecological system and their relevance to the research.

One of the main features of the SES is interconnectivity, which highlights the dynamic interactions and feedback loops between the social, organisational, community, individual, and societal elements that influence behaviour (Partelow, 2018). This is reinforced by Scarneo *et al.* (2019), who go on to add that the model's strength resides in its multilayer approach, calling for interventions that target numerous levels at the same time to encourage long-term transformation. Given that every setting has different factors influencing behaviour, its adaptability enables customized interventions (Miller *et al.*, 2012). The SEM's is a model used to better understand the SES theory and assist in the understanding of complexity and highlights the varied nature of behaviour change, supporting holistic solutions

that incorporate several variables (Fougères *et al.*, 2020). By incorporating these essential elements, the SEM offers a strong framework that enables scholars, decision-makers, and practitioners to create all-encompassing, contextually appropriate interventions for encouraging water conservation in schools and comprehending and addressing the intricate network of variables that influence behaviour in these settings.

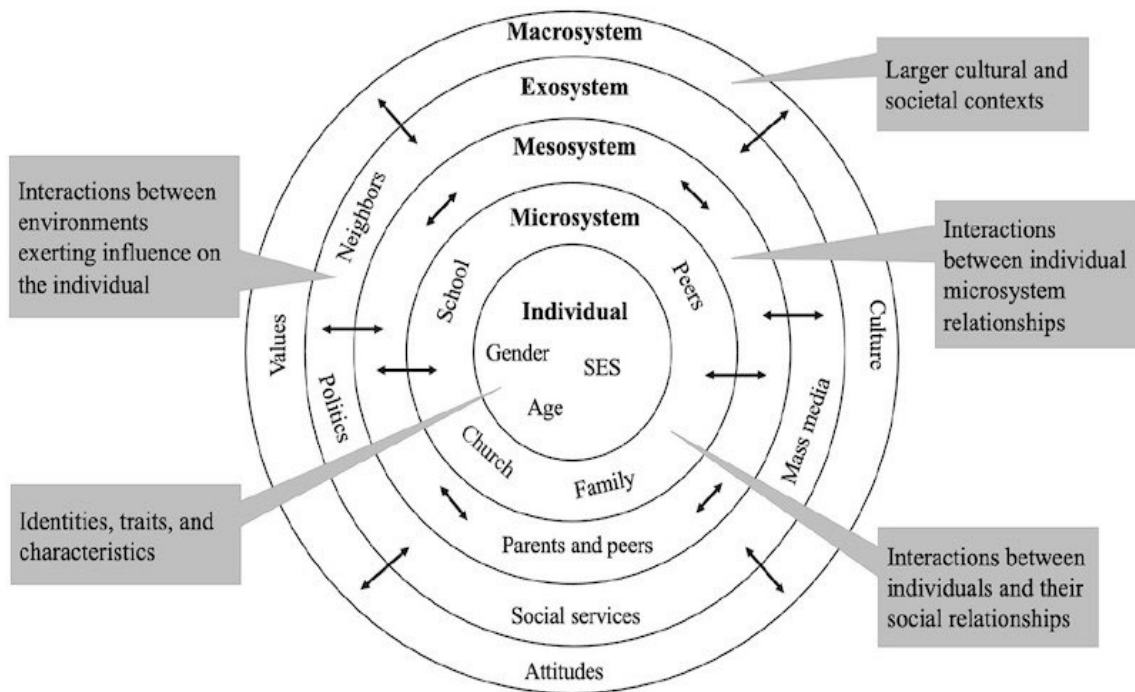


Figure 2.4: Social Ecological Model for understanding water conservation practices (adopted from Akerlof and Kennedy, 2013).

2.4.1 Individual level (Intrapersonal)

The intrapersonal or individual factors impacting water conservation practices are examined at the first level of the Social-Ecological Model (SEM). Individual traits, convictions, attitudes, and actions about water consumption and conservation are more important at this level (Akerlof and Kennedy, 2013). According to Thakur *et al.* (2022), behavioural decisions are significantly influenced by psychological factors, including attitudes regarding water scarcity, understanding of water conservation techniques, and the perceived significance of saving water resources. An essential component is self-efficacy, or the belief in oneself that one can implement and maintain water-saving behaviours. People's engagement in such behaviours is influenced by their perceptions of the benefits and hurdles associated with them, such as the benefits of water conservation methods and

the challenges to their implementation. Individuals' internal beliefs, values, and attitudes are included in this level, which forms the basis for their activities related to water conservation. To effectively design interventions targeted at promoting sustainable water use in school settings, it is imperative to understand and address these intrapersonal aspects.

2.4.2 Interpersonal level (Microsystem)

Within the framework of the SEM, people's attitudes and behaviours regarding water conservation practices in schools are greatly shaped by their social networks, which include their family, friends, and wider community connections (Partelow, 2018). Social media platforms serve as conduits for the sharing of knowledge, standards, and beliefs about conserving and using water (Rathwell and Peterson, 2012). An individual's views and habits can be greatly influenced by family dynamics and conversations about water shortage, responsible water usage, and conservation techniques (Liu *et al.*, 2020). Peers and friends in school environments shape people's adoption or resistance to water-saving behaviours through collective behaviours, peer pressure, and social norms (Van Vugt, 2009). Encouraging social networks can act as accelerators for behaviour change by exchanging stories, offering support, and cultivating a group commitment to conservation (Latkin and Knowlton, 2015). This highlights the crucial role that interpersonal relationships and social dynamics play in influencing water conservation behaviours within school environments. On the other hand, social circles that do not prioritize or actively discourage water conservation practices can present barriers to individual behaviour change.

2.4.3 Organisational level (Mesosystem)

A study conducted by EL-Nwsany *et al.* (2019) found that water conservation methods in schools are significantly impacted by a number of elements that are influenced at the organisational level of the Social-Ecological Model. School policies are essential because they set forth rules, regulations, and instructions about how to use, conserve, and manage water. When these regulations are clear and encourage conservation, they offer a framework for carrying out and maintaining water-saving projects. Furthermore, the viability of implementing conservation measures is significantly impacted by the infrastructure and resources that are available within the school setting. This is reinforced by Irfeey *et al.* (2023), who argue that sufficient facilities, such as water-efficient plumbing

fixtures, rainwater collecting systems, and water recycling mechanisms, increase the school's ability to conserve water effectively. Furthermore, the educational curriculum serves as a significant tool in changing students' and faculty members' behaviours and attitudes toward water conservation. Water conservation education integrated into many topics raises knowledge, comprehension, and a culture of responsibility for water usage, creating a favourable climate for long-term conservation efforts within the school community.

2.4.4 Community level (Exosystem)

The focus of the SEM at the community level extends beyond the direct social networks to incorporate the larger local community factors that influence water conservation measures in schools. EL-Nwsany *et al.*, (2019) state that this level evaluates the cultural norms, values, and collective behaviours connected to water use in the schools' immediate surroundings. It emphasizes the importance of community involvement and collaboration in promoting long-term water conservation measures. The school's approach to water conservation is shaped by community dynamics such as widespread attitudes toward environmental stewardship, current community-led programmes, and the availability of local resources. Partnerships with local stakeholders, non-governmental organisations, and community groups are frequently used in successful conservation programmes to apply collective knowledge, resources, and support. Furthermore, this level appreciates the significance of linking school-based activities with the beliefs and practices of the surrounding community in order to ensure the sustainability and acceptance of water conservation policies within the larger societal context.

2.4.5 Policy and societal level (Macrosystem)

The Macrosystem broadens to include the general policies, cultural norms, and societal attitudes that have a substantial impact on water conservation practices in schools at the Social-Ecological Model's Policy and Societal Level (Dahlberg and Krug, 2002). This level affects the whole social framework in which schools' function by encompassing national policies, legislative frameworks, and governmental laws controlling the management and conservation of water resources. The basis for school-based conservation initiatives is established by government laws pertaining to the distribution of water resources, the construction of infrastructure, and environmental preservation. Community perceptions and

behaviours are also greatly influenced by social attitudes toward water use and conservation, which are shaped by the media, public conversation, and cultural values. The promotion of a water-conserving culture through public campaigns, educational programmes, and advocacy efforts shapes societal norms that have a significant impact on individual and organisational behaviours in schools. This emphasises the critical role that larger social and policy contexts play in promoting sustainable water conservation practices at the school level.

2.4.6 Theoretical framework conclusion

By using the SEM to analyse water conservation methods in schools, a thorough understanding of the complex factors influencing student behaviour in these learning environments can be achieved. In order to provide focused educational initiatives that increase awareness and motivation, it is necessary to evaluate learners' knowledge, attitudes, and self-efficacy on water conservation on an individual basis (Chaudhary, *et al.*, 2017). Social networks, family involvement, and peer pressure can all be used to promote group commitment to conservation initiatives. Implementing clear regulations, incorporating conservation into curriculum, and guaranteeing access to water-saving infrastructure are examples of organisational strategies. Working with local stakeholders, starting community-driven projects, and coordinating school objectives with community norms are all necessary steps in involving the larger community by promoting lawful regulations that are beneficial to society, cultivating media campaigns that elevate the significance of water conservation in society, and coordinating school initiatives with larger national conservation initiatives. In order to sustain long-term conservation practices, this holistic approach acknowledges that effective water conservation in schools requires interventions at numerous levels, forming an ecosystem where individual acts are rewarded by supportive settings, policies, and community norms.

2.5 The gap identified within the literature review

According to Chaudhary *et al.* (2017) the comprehensive study of the literature on water conservation strategies used in schools, especially in water-scarce locations worldwide and in the African setting, highlights several achievements as well as difficulties. The recognised gap, however, is the lack of a synthesised understanding or integrated analysis that connects the data at multiple

geographical scales. The SEM is used to thoroughly explore the individual, interpersonal, organisational, community, and policy/societal levels of influence in this review; however, these insights are not combined into a single framework or comparative analysis across these levels. The literature fails to integrate these components into a comprehensive picture of the dynamics impacting water conservation in schools, instead providing a fragmented overview of successful initiatives, obstacles, policies, and lessons gained at each level alone.

Moreover, it is imperative to establish a bridge that connects the global, regional (African), and local views (South African, specifically in Gauteng). Although the review discusses programmes and difficulties in many nations and areas, it does not include a comparative analysis or synthesis that would highlight general trends, parallels, or discrepancies in water conservation strategies, obstacles, and achievements in various geographic contexts. This thorough investigation may provide insightful advice that can be applied to many contexts and geographical areas, improving the adaptability and efficacy of water conservation tactics in educational institutions.

In addition, there is not a strong focus in the literature study on how innovation, technology, or new trends relate to water conservation efforts in schools. Examining the possible effects of technological innovations, creative fixes, or more recent conservation trends (like smart water systems, IT-based monitoring, or educational technology interventions) could improve our knowledge of workable and sustainable strategies that are adapted to school environments wherever they may be found.

In order to provide a thorough understanding of water conservation strategies in schools, the identified gap thus involves the need for a synthesis, comparative analysis that integrates findings across multiple levels of influence, geographical scales, and technology developments. More efficient, contextually appropriate, and scalable programmes for encouraging sustainable water usage in primary schools across different water-demand regions, such as those in Gauteng, South Africa, could be informed by such an analysis.

2.6 Conclusion

This literature analysis highlights the complex nature of the difficulties and successes experienced in promoting sustainable water use. Diverse programmes

have demonstrated both achievements and continuing barriers in establishing a culture of water conservation from a global viewpoint to the African context, particularly in South Africa's high-demand areas like Gauteng. The SEM has been used as a lens to analyse the numerous layers of individual, interpersonal, organisational, community, policy and societal variables that shape behaviour in different educational environments. The review, however, emphasizes the urgent need for a synthesising and comparative analysis that connects fragmented findings across various levels, geographical regions, and technology improvements. An integrated strategy like this might provide essential information and pragmatic recommendations to support targeted, scalable, and long-term water conservation plans for elementary schools around the world, especially those in water-stressed areas like Gauteng, South Africa. Finally, promoting effective water conservation practices in schools necessitates collaborative efforts, innovative solutions, governmental support, and a comprehensive understanding of the complex interaction of factors driving behaviour change in these critical educational settings.

The next chapter addresses the research design and methodology that was used for the study.

CHAPTER 3: RESEARCH METHODOLOGY

3 Introduction

The current chapter focuses on the research design and methodology adopted for this study. The chapter begins by discussing the foundational research paradigm supporting this study, which is the interpretive paradigm. A description of the research approach is then provided, describing the reason behind adopting a qualitative research approach and the utilisation of a qualitative research design. The chapter then describes the study population, the selected sampling procedure and sample size. Furthermore, it describes the data collection methods and analysis techniques applied to this study. Finally, the chapter concludes by discussing the critical aspects of trustworthiness and ethical aspects that pertain to this study.

3.1 Research Paradigm

This study's research methodology is premised on both epistemological and ontological perspectives, making it imperative to adopt an interpretive research paradigm. According to Davies and Fisher (2018), interpretive research seeks to understand how individuals interpret and construct meaning around the social phenomena they engage with, instead of aiming to identify universal truths or context-free knowledge. In the context of this study, the social phenomenon being explored is possible changes in water conservation practices in learners and educators because of Rand Water's Water Wise Education intervention programmes. Critics of interpretive epistemologies have expressed issues about their validity and subjectivity (Putna and Banghart, 2017). However, as Alharahsheh and Pius (2020) highlight, that the interpretive paradigm denies the notion of an independent, verifiable reality separate from the researcher's interpretation, instead endorsing the concept that reality is socially created and can manifest in a variety of ways. Given the need to obtain a deep understanding of the subjective realities related to possible changes in water conservation practices in learners and educators because of Rand Water's Water Wise Education intervention programmes, the interpretive research paradigm aligns with the objectives of this study.

3.2 Research Approach

For this study, a qualitative research approach was considered most suitable. Kyngäs (2020) stresses that qualitative research delves into new areas of investigation, concentrating on experiences and phenomenon about which limited knowledge is available. Additionally, qualitative research is characterised by its emphasis on exploring social or human problems in-depth and the multifaceted methods associated with it (Islam and Aldaihani, 2022). Given that this study centres on exploring the possible changes in water conservation practices in learners and educators because of Rand Water's Water Wise Education intervention programmes, a qualitative research approach was the most appropriate choice.

3.2.1 Research design

According to Sileyew (2019) research design is the specification of methodologies and procedures for gathering data for a study. The general operational pattern or structure of the project specifies what information is to be collected from which source and how. The consideration of data collection tools, sample methods, and data processing methodologies is also part of research design. This research followed a qualitative interpretive design.

3.2.3 Research participants

Three primary schools were selected from Rand Water's Water Use Efficiency Index Map (Figure 1.1), from high water use areas. Twenty (20) randomly selected Grade 7 learners from each primary school were selected from the class registers to complete the pre and post intervention questionnaires. This gave a total sample size of 60 learners. Two Natural Science Educators from each school were also purposefully selected to participate in completing the pre and post intervention questionnaire. The two were chosen because they were exposed to the WWET programme, and they are also exposed to the learner's water conservation practices based on their involvement in the school's environmental club, exposure to environmental programmes and their knowledge of sound water conservation practices. To protect the reputation of the schools and of the learners, the schools were given alphabet letters for identification and the, for an example Learner J from school B.

3.2.4 Sampling

The schools were purposefully selected from the Water Use Efficiency Index Map based on their proximity to each other and areas with high water utilisation areas. In the research study, random sampling was used to select the 20 grade 7 learners from a class register. Although all the grade 7 learners were exposed to the Water conservation intervention, only the sampled 20 per school participated in the research. Permission was sought from the selected learners' parents by the researcher to proceed with the study. Both the pre-questionnaire and observation took place a few days before the intervention, while the post-observation and questionnaire were conducted one week after the intervention. The total number of learners who participated in the study was 60.

3.2.5 Data generating tools.

To generate data questionnaires (ANNEXURE C) and structured observation sheets (ANNEXURE B) were used as data collection tools. Both pre and post questionnaires, along with site observations, were employed for participants and learners, allowing minimal interaction with the researcher to avoid bias and interruptions in the school curriculum schedule. The learners were given pre- and post-questionnaires to assess their water conservation knowledge. A 30-minute written pre-intervention questionnaire was administered by the class teacher and the researcher. After a few days, the learners participated in the Water Wise Education team intervention programmes at the school. Throughout the intervention, the researcher observed, distributed questionnaires, and monitored the school's water meter to observe any changes in water utilisation before and after the intervention.

3.2.6 Data collection

A qualitative method involving structured observations and questionnaires was utilised, incorporating pre-intervention and post-intervention assessments. The researcher gathered data through questionnaires distributed to 20 grade 7 learners in each school. The choice of grade 7 learners stemmed from the assumption that they possessed the ability to comprehend and respond to the questionnaires effectively. Qualitative research, according to Imtiaz (2013), centres on data collected firsthand by the researcher, encompassing observations, questionnaires, participant observation in natural settings, and the

examination of documents, case studies, and artifacts. The study employed pre- and post-intervention questionnaires along with pre- and post-intervention observations as data collection methods. The research involved observing learners within their respective schools, specifically focusing on their water usage practices. Activities such as ensuring tap closure after usage or opting for a container instead of drinking directly from a tap were observed, as outlined by Balian (1999).

3.2.7 Observations

A structured observation sheet was used for the pre and post intervention at each school. Some key questions for this were:

- Does the school have water wise tools that promote water wise practices such as dual flush toilets, rubbish bins?
- Do the learners close the tap after using it?
- Do the learners close a tap that has been left open?
- Do the learners apply water wise practices at the school, for example do they use a cup/water bottle instead of hands when drinking water at the tap?
- Do the learners put litter in the bin?
- Are there other environmental interventions at the school that may have an influence on the learners' attitudes and practices towards water?

The researcher completed a structured observation sheet to assess the school environment, including the school grounds and water utilisation. Cell phone cameras were utilised to capture evidence, such as images of leaking taps, broken toilets, the school's water meter before and after the intervention, the vegetable garden, and the general environment (e.g., littering). As a precaution, photographs of the learners that were taken during the study have been doctored to cover the faces of the learners to comply with ethical procedures.

3.2.8 Questionnaires

A questionnaire is a research tool comprised of a series of questions aimed to collect information from respondents through a survey (Goldschmidt and Matthews, 2022). A typical research questionnaire includes open-ended

questions. Open-ended questions allow respondents to elaborate on their responses and thoughts. The questionnaires (ANNEXURE C) for this study included mainly open-ended questions and was completed with the help of the class teacher. This was because the learners were still young with some having barriers such as language (vernacular) or reading challenges. Some key questions for this were:

- What do you know/remember about Rand Water?
- What do you know/remember about Water Wise?
- If you see a tap left open, do you close it and why?
- Do you use a cup/bottle or hands when drinking water at the tap and why?
- What could be the practical reason for a tap to be leaking?

The role of the researcher was not to influence the learners in any way but to observe them, without causing any discomfort. The amount of time each learner was expected to take on each questionnaire was approximately 30 minutes. This was the same for the Educators.

3.3 Data Analysis

The researcher employed the thematic analysis methodology, as described by Braun and Clarke (2012), on the collected data. This method entails a systematic examination of the data to recognise and interpret recurring themes associated with possible changes in water conservation practices in learners and educators because of Rand Water's Water Wise Education Programme. The approach follows the six steps outlined by Braun and Clarke (2012):

Data familiarisation

The initial stage of thematic analysis involved the researcher becoming well-versed with the data by reading the responses provided by the participants repeatedly to establish familiarity. At this phase, the researcher possessed a comprehensive understanding of the data.

Generating preliminary codes

The second phase involved identifying and labelling key concepts or themes in the responses to research questions. For example, for question one of on the data

gathering tool asked: Have you been exposed to the Water Wise Program? Explain what was done during the program?

Code: Programme Exposure

Examples: "Yes," "No," "partial exposure," "attended trainings," "educational sessions."

Theme exploration

The third phase involved cross-checking possible themes against the dataset to validate them. This step was crucial in aligning each theme with the data and its relevance to the research question.

Reviewing identified themes

During this stage, the researcher reassessed and refined the identified themes. Critical examination ensured accurate representation of relevant data concerning possible changes in water conservation practices in learners and educators because of Rand Water's Water Wise Education Programme, addressing any overlapping or redundant themes.

Definition and naming of themes.

After reviewing the initial themes, the researcher ensured analysis validity and reliability (trustworthiness) of the study findings by engaging in reflexivity where they acknowledged and addressed potential biases and preconceptions.

Report writing

In this final phase, identified themes served as the foundation for a comprehensive report detailing findings, possible changes in water conservation practices in learners and educators because of Rand Water's Water Wise Education Programme. The report findings in Chapter 4 integrate narratives, quotes, images, and data excerpts supporting identified themes, providing a nuanced understanding of the issue.

3.4 Validity and trustworthiness of the data

Wys *et al.* (2017) describe research validity as the application of a method in a specific context to draw conclusions that enhance comprehension of the studied

phenomena. Inherent in all research processes, Noble and Smith (2014) considered research bias a potential threat to study validity. Awareness and management of potential bias were necessary as they could influence research validity.

To ensure data validity, data from various gathering techniques were employed (Merriam, 2002; Bowen, 2009). Specifically, observations and questionnaire analysis provided the data in this instance. Additionally, Creswell and Miller (2000) emphasised the importance of detailed descriptions regarding the study setting, participants, and themes for research validity. In the context of this study, the researcher conducted triangulation of themes from different data sources, namely observation and survey questionnaires of the educators' and learners, this served as a strategy to enhance the trustworthiness of the findings. Triangulation involved cross-verifying information from the different sources to ensure reliability. For example, the following was done:

3.4.1 Observations

The researcher conducted direct observations in the school environment to capture real-time behaviours related to water usage and conservation using a check list. This involved observing how learners drink water, their handwashing practices, and their response to leaking taps.

3.4.2 Questionnaire

Simultaneously, the educators' and learners' questionnaires were administered to gather qualitative data regarding participants' knowledge, attitudes, and behaviours related to water conservation. Questions used covered aspects such as awareness of the Water Wise Programme, understanding of water reuse, and perceptions on water-saving strategies.

3.4.3 Triangulation Process

After collecting data from both observation and questionnaires, the researcher conducted thematic analysis and the themes that emerge independently from each data source. For instance, themes related to the awareness of the Water Wise Programme, and attitudes toward water conservation were identified separately.

3.4.4 Comparative analysis

The researcher compared the themes that emerged from the observations with those from the questionnaire responses. Consistency and convergence in the identified themes across these two different data sources strengthened the validity and reliability of the findings.

3.5 Limitations

Limitations	Mitigation strategies
The recurrence of COVID-19 pandemic cases and subsequent school restrictions posed a potential limitation to the Water Wise conservation intervention programmes' implementation in schools.	While questionnaires could still be completed online, however, not all learners have cell phones or even data thus the face-to-face methods had to be employed.
The structured questionnaires were designed and presented in English, acknowledging that some learners struggled with reading and writing in this language, posing a significant study limitation	To mitigate this, the study considered Educators being available to aid learners in understanding questions in their native languages, encouraging the use of these languages in their responses.
There were parents of randomly selected learners that refused their children's participation in the research.	The researcher randomly selected alternative learners to fill those positions in the study.
Conflicting school schedules due to events such as schools closing, exams and even loadshedding.	The researcher had to adapt to the school's availability and time that could be allocated for the research to be conducted.

Table 3.1: Observations of water conservation practices

3.6 Ethical considerations

The researcher was required to obtain permission from Rand Water and the Gauteng Department of Education to conduct the research, referring to Annexures K, L, and F to secure consent for utilising the Water Wise Education Team Programme as a case study. Notably, it was highlighted that the publication of this study would not maintain anonymity for the Water Wise Education Intervention Programme and Rand Water. To mitigate potential risks to Rand Water's reputation, the researcher committed to ongoing discussions with participants and

relevant Rand Water managers regarding any programme limitations and the suitability of data publication. The researcher was required to obtain ethical clearance from the IIE MSA to conduct the research.

Additionally, prior to concluding the study, arrangements were made for meetings with the respective Rand Water manager and the Department of Education research chair. These meetings aimed to address concerns that might negatively impact the Department of Education and Rand Water or tarnish their reputation, as per the agreement signed between the researcher, Department of Education, and Rand Water.

Attachments for seeking permissions included: (a) An ethical clearance certificate issued by the IIE MSA (Annexure F). (b) Questionnaires and observation sheets used in the research (Annexure C, E, and D).

Consent forms were devised for adults (Educators and groundsmen) and learners' parents/guardians (Annexure G and H). School consent forms were provided to the principal and the School Governing Board (Annexure I).

Minimising risks to vulnerable participants, the researcher's interaction with learners was limited to the handover and collection of questionnaires pre- and post-intervention, allowing only 30 minutes for completion. Structured observations, devoid of learner contact, were conducted with a teacher or groundsman present.

As a precaution, photographs of learners that were taken during the study were doctored to cover the learner's faces. Anonymity was maintained for learners answering questionnaires, with assistance from class Educators and school assistants for those having trouble understanding the questionnaires.

Questionnaires and observation sheets served as information-gathering instruments while ensuring participant anonymity through assigned numbers and alphabetical letters for schools in publications. Permission for photographs was sought from participants and their parents/guardians for illustrative purposes only, focusing on actions rather than the learners themselves.

Participants received no benefits or remuneration for their involvement. The research aimed to assess whether the Water Wise Education Team's

interventions had a positive impact on water demand management, specifically in learners' water conservation practices post-intervention.

The researcher aimed to ensure confidentiality and anonymity of records, maintaining participant anonymity and confidentiality. Participants retained the right, as per the Protection of Personal Information Act, to request detailed explanations regarding their child's confidentiality, data storage, and potential use in future research. Participants had the option to withdraw from the research at any point without obligation.

Crucially, participants were informed that the research focused on water conservation practices post-intervention, aiming to assess intervention outcomes in schools, and was not about them or their children.

3.7 Conclusion

This chapter has described the detailed research design and methodology undertaken to explore the critical issue of water conservation practices in three primary schools within high water demand areas facing water scarcity. Embedded within the interpretive paradigm, the chosen qualitative research approach and design were comprehensively described, explaining the motivation behind their selection. The description of the study population, the sampling technique, and the determined sample size provided clarity on the parameters of the study. The outlined data collection procedures and subsequent analysis procedures shed light on the systematic approach applied in this study. Significantly, the chapter emphasised the significance of trustworthiness and ethical considerations, highlighting the necessity for rigor and ethical integrity throughout the research activities.

CHAPTER 4: STUDY FINDINGS

4 Introduction

The chapter presents the study findings from the data collection process. This study aimed to determine whether Rand Water's Water Wise Education Team's water conservation intervention programmes have the desired outcomes of improving water conservation practices in learners in schools located in high water demand areas within Rand Water's area of supply. This chapter illustrates the prominent themes, sub-themes and recurring patterns derived from the analysis of data obtained through pre- and post-questionnaires that were used to determine the water conservation knowledge of the learners as well as the educators and groundsman in three schools. Employing a structured approach, the chapter starts by describing findings based on the observations made by the researcher, followed by data obtained from the questionnaires completed by the educators/educators and finally by the learners.

4.1 Findings based on the observations.

Category	Pre-Intervention	Post-Intervention	Change in Percentage
Drinking Water			
- Learners using hands	70%	65%	-7.14%
- Learners using containers	30%	35%	16.67%
Handwashing			
- Under running tap	80%	75%	-6.25%
- Water reused	20%	25%	25%
Toilets			
- Leaking	40%	35%	-12.50%
- Water-efficient devices	10%	15%	50%
Dripping Taps			
- Percentage of dripping taps	5%	10%	100%
Water Meter/Bill			
- Presence of water meter	60%	60%	No change
- Receipt of water bill	0%	0%	No change
Runoff Water			
- Captured and harvested	10%	10%	No change
Waste Management (Litter Bins)			
- Reported litter issues	Yes	Yes	No change
Recycling Initiatives			
- No recycling initiatives	100%	100%	No change
- Some community involvement	Some	Some	No change
Educational Resources			
- Minimal educational resources	Yes	Yes	No change

Environmental Clubs and Policies			
- No clubs or policies	Yes	Yes	No change

Table 4.1: Observations of water conservation practices from 3 schools

Table 4.1 provides a comprehensive picture of the three schools water usage, conservation efforts, waste management practices, and educational initiatives before and after the Water Wise Programme. To determine the percentages a binary scale (Yes/No or Hand/Container) indicating the frequency of each behaviour was used to determine the percentages shown in the table. Initially, most learners relied on using their hands to drink water, demonstrating a prevalent lack of containers (70% vs. 30%). Post-intervention, while the trend remained the same, there was a slight uptake in container usage (35%), (Figure 4.1) implying a minor change in behaviour. Handwashing practices saw a decline in the percentage of learners using running taps, which could be revealing possible water-saving measures being implemented (80% to 75%). However, the positive increase in water reuse practices (20% to 25%) implies an encouraging response to water conservation efforts.



Figure 4.1: Learners using hands for drinking water post intervention. (Photo: Mndawe. S, 16 October 2023).



Figure 2.2: Learners using containers to drink water post intervention. (Photo: Mndawe. S, 26 October 2023).

Regarding infrastructure, problems with leaking toilets persisted, even though there was a slight improvement in water-efficient devices (10% to 15%). However, there was a worrying increase in the number of dripping taps (5% to 10%), (Figure 4.3) indicating a possibility in deterioration in maintenance post-intervention. Notably, while the presence of a water meter (60%) remained unchanged (Figure 4.4), there was no receipt of a water bill reported in the pre and post intervention, in some cases the water meters were broken. The absence of change in recycling initiatives (100%) and the minimal involvement of community members in waste management suggests a

stagnation in initiatives and there is a need to improve these areas.

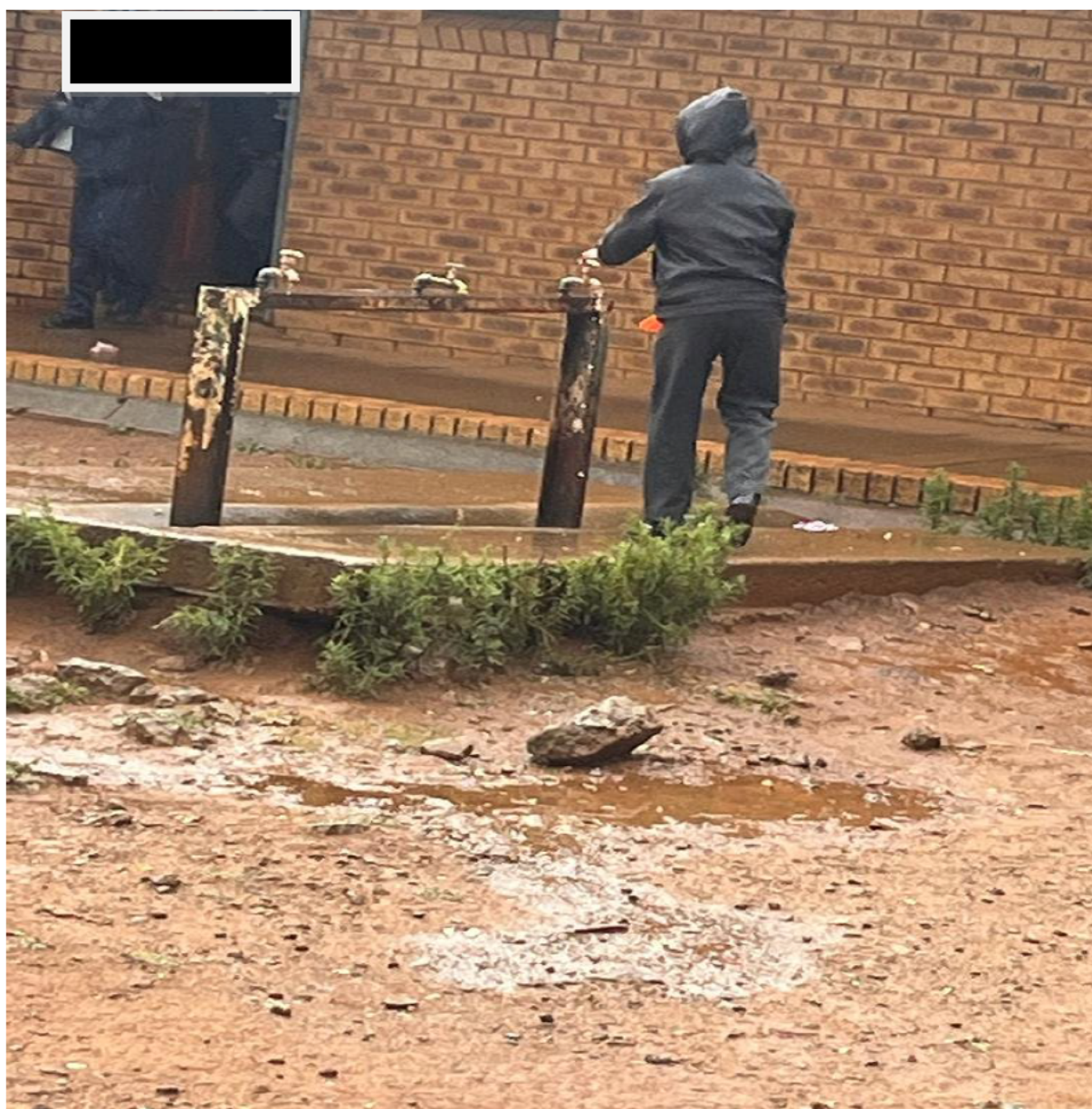


Figure 4.3: Dripping water taps. (Photo: Mndawe. S, 16 October 2023).

Furthermore, no Water Wise educational resources such as posters, water bottles and washers handed over to the schools were used by the school post the intervention and no school environmental policies were amended to accommodate water conservation post the intervention. The schools continued to experience litter problems, and while there were educational resources available, the absence of significant improvements post-intervention suggested the need for more robust water conservation education initiatives. In general, the table highlights both positive changes, for example the increase in water reuse, and concerning trends, for instance

the worsening conditions of leaking toilets and dripping taps, requiring more focused and comprehensive interventions in water conservation and infrastructure maintenance to achieve sustainable improvements across the three schools.



Figure 4.4: Broken water meter at school A. (Photo: Mndawe. S, 26 October 2023).

4.1.2 Water conservation efforts and infrastructure

Findings shed light on the selected schools' initiatives and challenges in conserving water and sustaining appropriate infrastructure. Regardless of observed water runoff from taps to a non-functional garden, the lack of functionality due to blockages and litter hinders effective water conservation. Furthermore, water from taps and gutters could have been an asset for irrigation (Figure 4.5) had the garden been operational, indicating a missed opportunity for using water efficiently.



Figure 4.5: Runoff water that could be used for irrigation. (Photo: Mndawe. S, 16 October 2023).

4.1.3 Environmental impact and littering

This theme is premised on the environmental impact caused by littering, particularly evident in observations that show significant litter accumulation, which also blocks waterways (Figure 4.6). The limited availability of dustbins (Figure 4.7) because of theft and poor service delivery worsens the littering issue. Furthermore, the absence of robust recycling programmes suggests a lack of resources or coordinated programmes for effective waste management.



Figure 4.6: Litter blocking the waterways. (Photo: Mndawe. S, 26 October 2023).



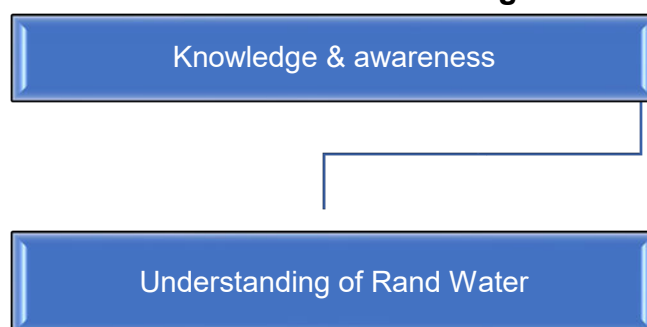
Figure 4.7: Availability of recycling Dustbins. Dustbins locked to prevent theft. (Photo: Mndawe. S, 17 October 2023).

4.2 Study findings based on thematic analysis

As discussed in Chapter 3, data analysis followed Braun and Clarke's (2012) thematic analysis, which involved identifying, analysing, and reporting themes from the qualitative data. The thematic analysis indicates that the Water Wise Programme has specifically influenced certain themes related to participants' experiences, knowledge, and behaviours regarding water conservation. However, it also highlights areas where

perceptions and behaviours have shown no change, possibly due to deep-rooted attitudes or complexities beyond the scope of the water conservation intervention.

Figure 4.2.1.a Theme 1: Educators' knowledge and awareness



Pre-intervention, the Water Wise Programme seemed to have a foundation of recognition but a varied depth of understanding among the educators as shown in the Figure 4.2.1.b below. Some initial perceptions indicated a general awareness of Rand Water premised on educating learners about water conservation practices within the selected schools, including a range of associations. Some viewed the organisation as supplying clean water and some recognising its role in educating the communities about water conservation and wise usage of water. However, the depth of understanding differed, with some participants understanding RW as a water purification entity while others associated the organisation more directly to educational activities. Below is what some of the educators indicated:

“A company that supplies water” (Educator, A, School A).

“Before the Water Wise programme, I knew Rand Water had something to do with clean water, but I didn't get the full picture. Now, I see it's not just about purification; it's about educating our learners and communities on using water wisely.” (Educator, J, School B).

“It is a water purification company that gives water to Johannesburg residents” (Educator, D, School C).

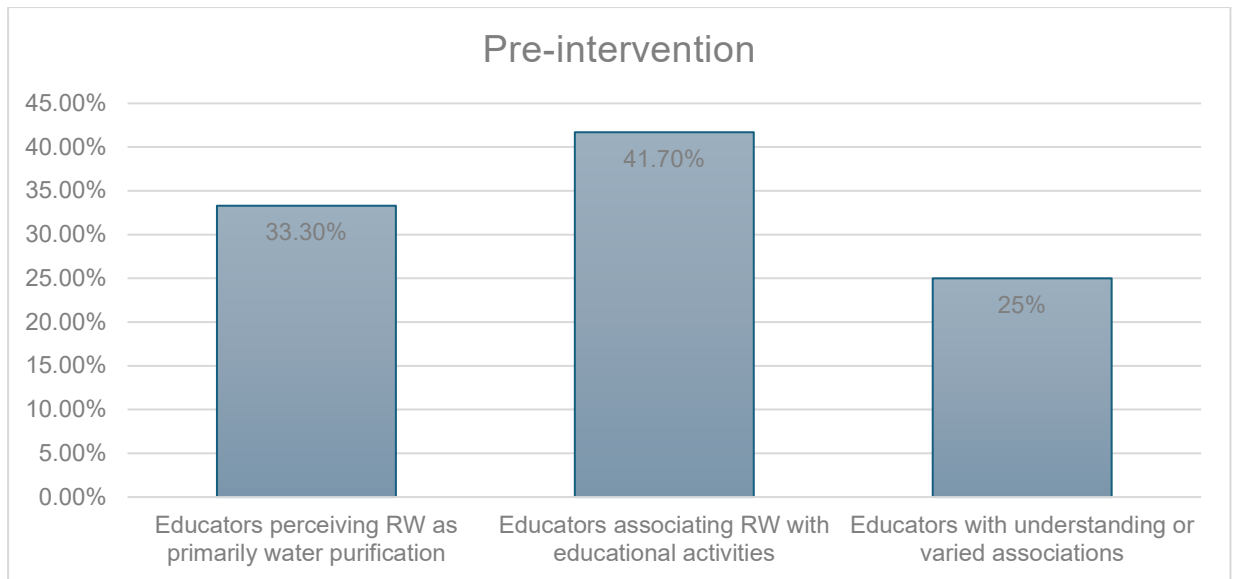


Figure 4.2.1.b: Educators understanding of Rand Water pre intervention.

Post-intervention, there appears to be a considerable impact on perception and understanding. Participants likely demonstrated a more refined and nuanced understanding of Rand Water, possibly acknowledging its multi-faceted approach, highlighting both water educational and conservation practices. The intervention might have clarified some misconceptions and enhanced the understanding of Rand Water as a company that promotes values of water conservation practices among learners, possibly highlighting specific strategies for water conservation within the primary schools. Overall, the post-intervention phase likely revealed a more coherent and aligned understanding of Rand Water's objectives and methodologies, demonstrating an enhanced perception of its impact on water conservation practices among the educators as indicated by the following quotes:

"It is the company that teaches about water." (Educator, B, School C).

"Rand Water introduced the water programme to us; they provided practical ways to instil water conservation values. I feel more aligned with their objectives now, and I can see the impact it's having on our school's water practices."(Educator, E, School A).

"The Water Wise Programme really opened my eyes to the broader approach Rand Water takes. It's not just about supplying water; it's about educating our learners and providing values of conservation. I never knew the depth of their

initiative until now. It's about being knowledgeable on how to use and save water wisely" (Educator, F, School B).

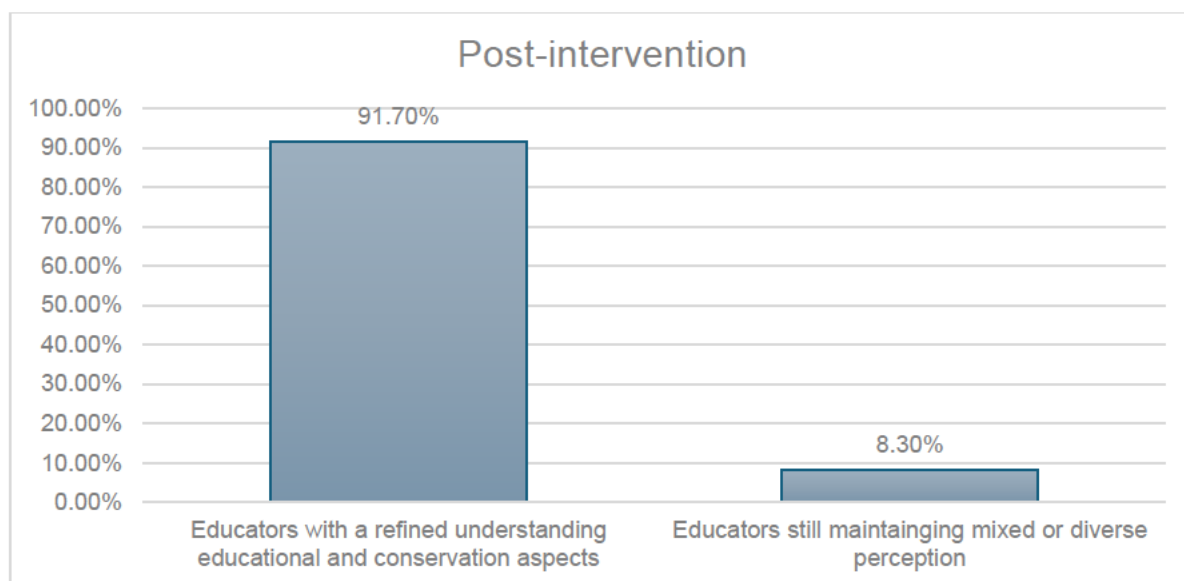
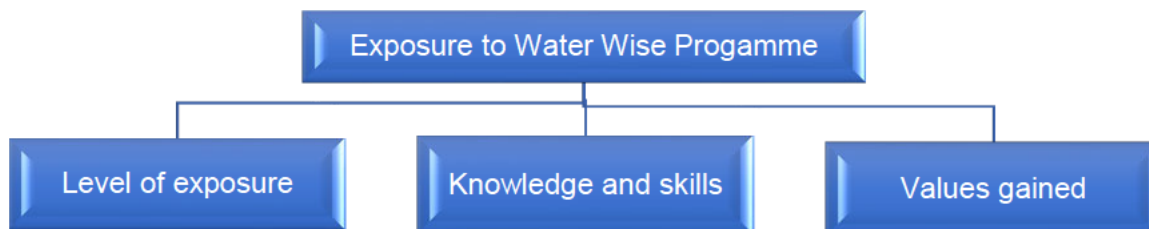


Figure 4.2.1.c: Educators understanding of Rand Water post intervention.

Figure 4.2.2.a Theme 2: Exposure to water wise programme



The study findings highlight a mixed impact on knowledge, skills, values, and practices among the educators. There is evidence that the educators did acquire some knowledge regarding water conservation, particularly understanding the significance of saving water and the process of cleaning water. For example, some participants had the following to say:

"The programme helped me understand the importance of saving water and the importance of water purification. Now, I know the importance of educators in conserving this precious resource." (Educator, K, School, A).

While some educators gained practical skills such as knowing how to replace a rubber in the tap, it seems that the values linked with water, for instance valuing its

conservation, were not embraced by everyone. Interestingly, some educators showed improved practices, proving an effort to conserve water by using cups and lunch boxes for drinking water, showing a partial adoption of water conservation behaviours.

“The programme taught me to detecting a leakage using a food colorant, changing a worn-out rubber” “Finding/detecting leaks” (Educator, D, School, B)

"I've made changes in my daily routines. Now, I use cups and lunch boxes for drinking water, a small step towards adopting water conservation behaviours. It's about applying some changes into our habits."

Overall, even though there is evidence of knowledge acquisition and small changes in practices, there is inconsistency between knowledge acquisition and consistent behavioural changes regarding water conservation.

Figure 4.2.2.b shows the pre and post intervention data with regards to the levels of exposure to the Water Wise Programme in terms of skills, knowledge, values and practices.

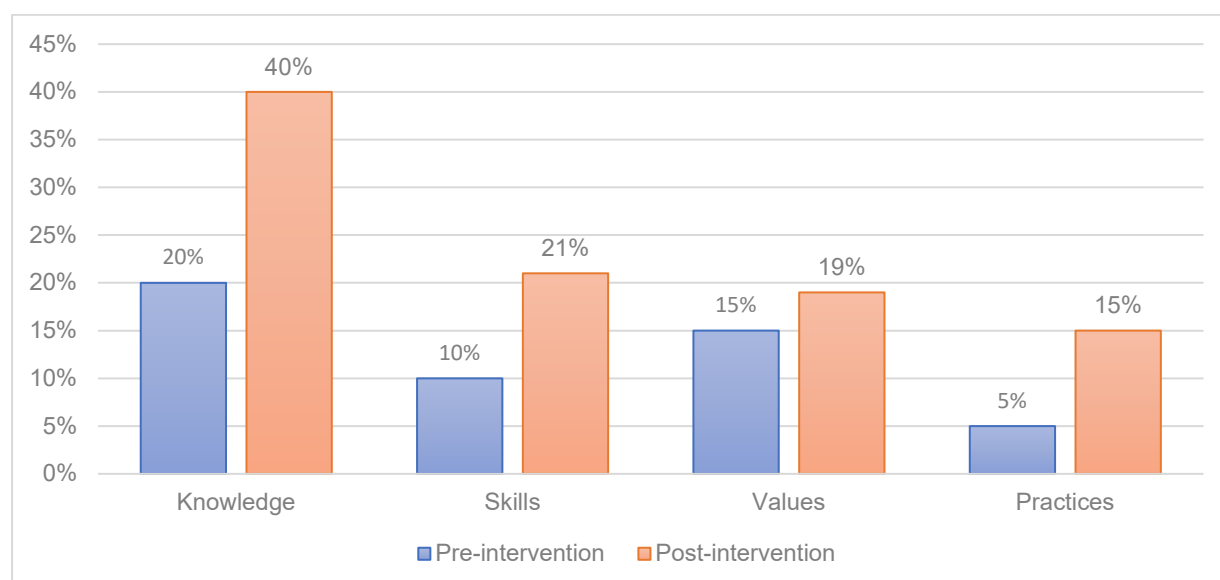
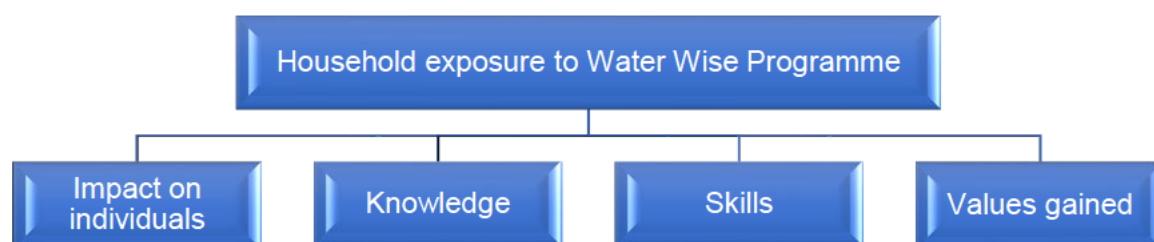


Figure 4.2.2.b: Exposure to the Water Wise Program.

Figure 4.2.3.a **Theme 3: Household exposure to Water Wise Programme**



The findings regarding the educators' household exposure to the Water Wise Programme exhibit a mixed outcome in terms of knowledge, skills, values, and practices. While some educators appear to have acquired knowledge about water conservation and understanding its source, there remains a gap between this knowledge and practical application. This could imply that the Water Wise Programme might not have successfully addressed the challenges hindering behaviour change at household level. Even though there is evidence of some knowledge acquisition regarding water sources, purification methods, and tap maintenance, the observed behaviours such as leaving taps running reveal a gap between knowledge and actual application. The lack of change observed in values and practices post-programme might suggest that the intervention did not sufficiently engage participants or required follow-up support to reinforce behavioural changes. Overall, the findings show a persistent disconnect between knowledge acquisition and actual behavioural changes, revealing a limited impact of the Water Wise Programme on household practices despite the exposure and educational efforts. Some educators had the following to report:

"Although we learnt a lot about water conservation, we still find ourselves leaving taps running at times. There is a gap between knowledge and action"
(Educator, M, School, A)

"En though I learned a lot, breaking habits like leaving taps running is challenging. It is about making a conscious effort to change our behaviors at home" (Educator, E, School, C)

"The Water Wise Program was engaging, but there's a challenge in translating knowledge into everyday action at home." (Educator, G, School, B)

“Checking for leakages around the house” (Educator, K, School, C)

Figure 4.2.3.b shows the pre and post intervention data with regards to the household levels of exposure to the Water Wise Programme in terms of skills, knowledge, values gained and practices.

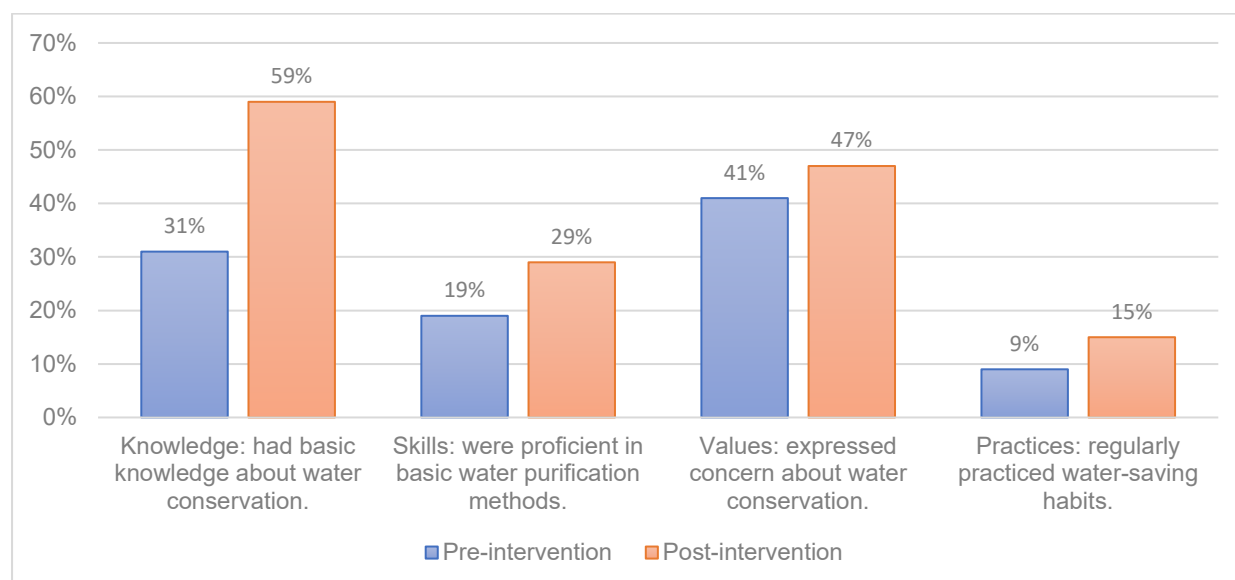
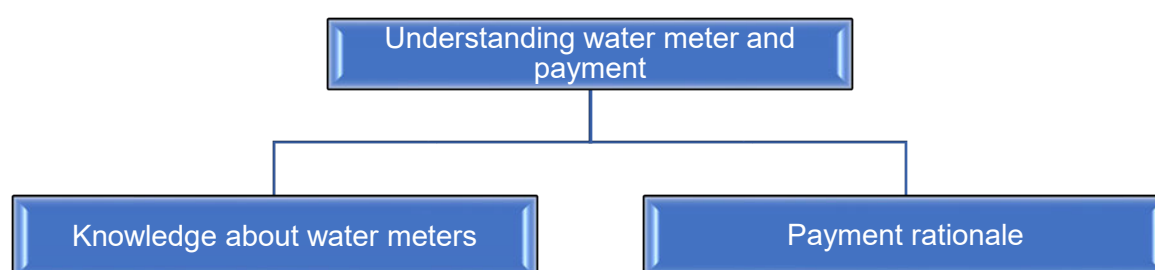


Figure 4.2.3.b: Household exposure to Water Wise Programme.

Figure 4.2.4.a Theme 4: Understanding the water meter and payment.



Pre-intervention, findings show a baseline of limited understanding regarding water meters and payment rationale among the educators. The findings revealed uncertainty or a lack of knowledge about the location of water meters and the logic behind water payments. However, there were indications of possible exposure to payment concepts through the Water Wise Programme, though there was not a clear indication of practical application. This is evidenced by the following quotes:

Location of water meters

"It is located at the back of the classes next to the garden". (Educator, C, School, A)

"I don't know where it is located". (Educator, G, School, A)

"Next to the gate," (Educator, B, School, C)

Payment rationale

"In order for water providers to keep with the new innovative ways to provide safe and clean water." (Educator, D, School, B)

"Because water is expensive and comes from other countries and needs to be cleaned using different expensive chemicals." (Educator, A, School, C)

"Because it is a limited resource, and it costs money to purify it before consumption" (Educator, C, School, B)

Uncertainty about water payments

"I don't understand why we should pay for water, yet it is the government's responsibility" (Educator, A, School, B)

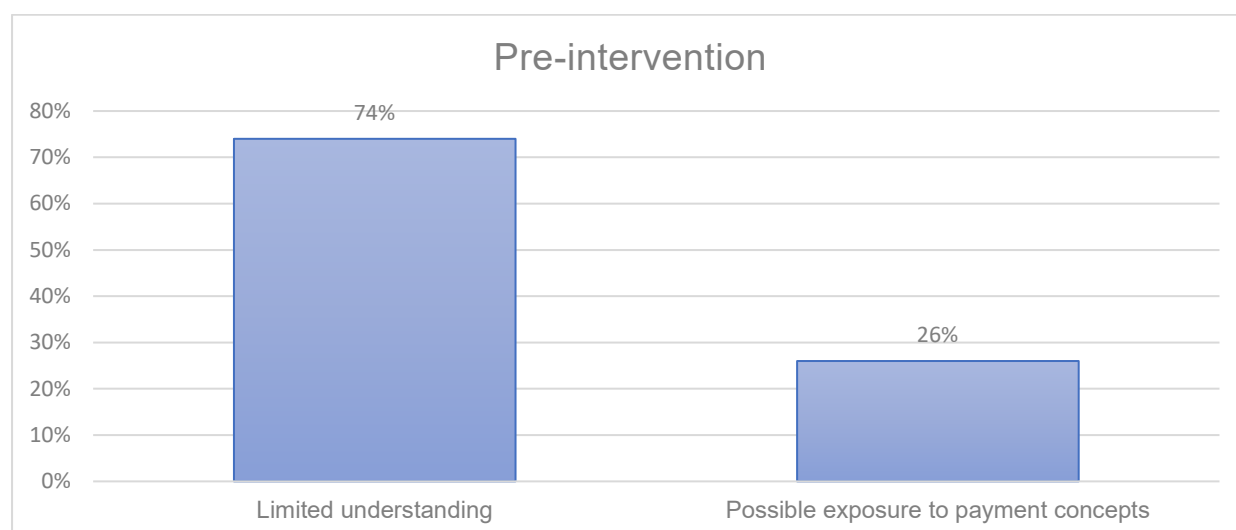


Figure 4.2.4.1.b: Understanding water meters and payments.

Post-intervention (Figure 4.2.4.1.c), there appeared to be a mix of continued uncertainty about water meter locations and payment rationale, implying that the intervention might not have considerably impacted this specific aspect of knowledge.

However, there could be an improved recognition of the existence of water meters based on one response indicating a specific location “*next to the gate*,”- (Educator, B, School, C) possibly demonstrating a slight improvement in awareness. However, the overall understanding of payment logic remained generally unchanged. The intervention might not have effectively addressed or clarified concepts related to water meters or payment rationale based on the study findings, showing a limited impact in this specific area of knowledge acquisition or application among the educators.

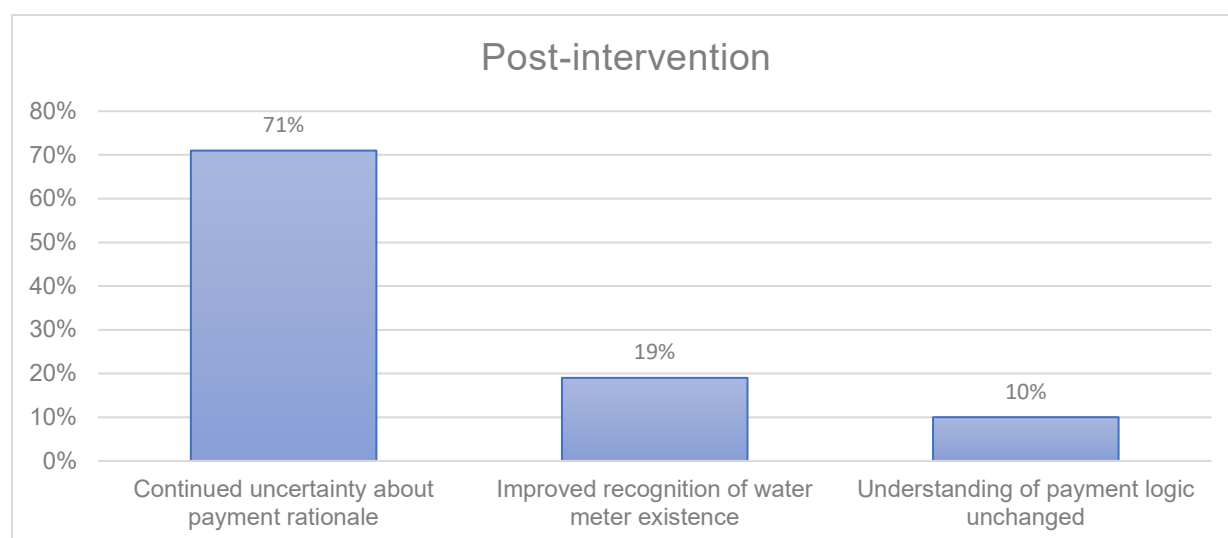
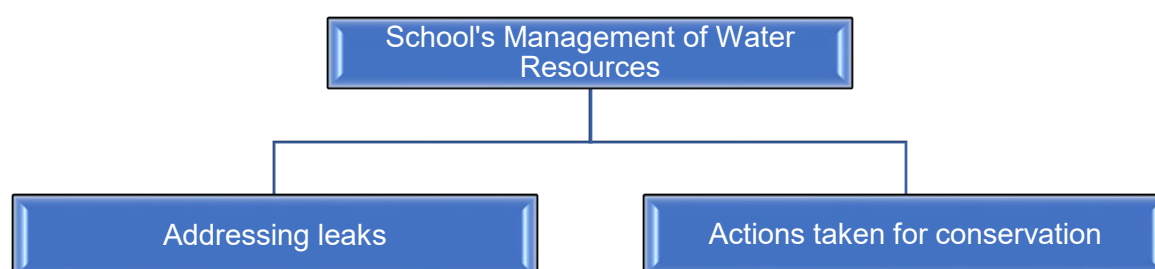


Figure 4.2.4.1.c: Understanding water meters and payment post-intervention.

Figure 4.2.5.a Theme 5: Schools management of water resources



Pre-intervention (Figure 4.2.5.b), the schools exhibited a proactive stance towards water conservation, albeit with a reliance on external individuals like an “*uncle*” or “*Madala*”- (Educator K, School, B) to fix water leaks, along with educators’ supervision of learners’ water usage. Although showing efforts to manage water resources, there appeared to be a decentralised approach with ad hoc solutions instead of a systematic water conservation strategy.

“We have an uncle who fixes broken taps” (Educator C, School, B)

“Madala helps with fixing the taps.” (Educator K, School, B)

“The school has dedicated staff members that make sure that learners don't waste water.” (Educator H, School, A)

“There are designated personnel to find and repair leakages at the earliest convenience.” (Educator F, School, B)

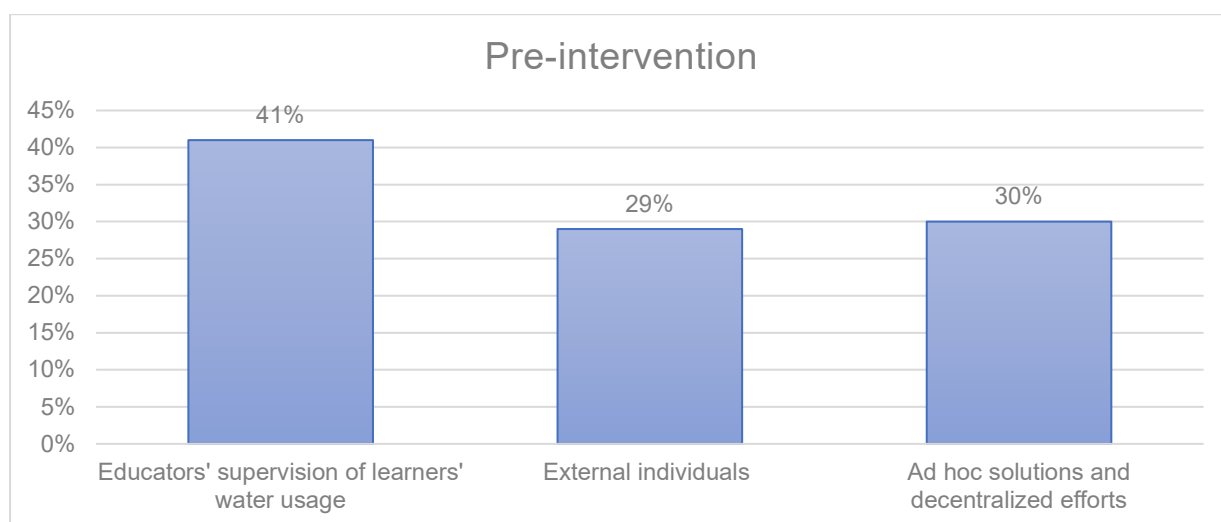


Figure 4.2.5.b: Schools management of water resources.

Post-intervention the impact of the Water Wise Programme appears evident in the schools' refined strategies (Figure 4.2.5.1.c below). There might be a shift towards a more organised and structured approach, with an enhanced understanding of water conservation principles among the educators. The Water Wise Programme possibly expedited a transformation towards a more comprehensive water conservation framework, potentially leading to the formation of dedicated in-house systems or personnel for fixing water leaks and encouraging water conservation across all the three schools. The schools' reliance on outside help might have reduced as internal systems became more robust, indicating a more empowered and informed approach to water conservation. Overall, the post-intervention phase possibly shows a change from ad hoc solutions to a more centralised, coordinated, and informed approach towards water conservation within the schools.

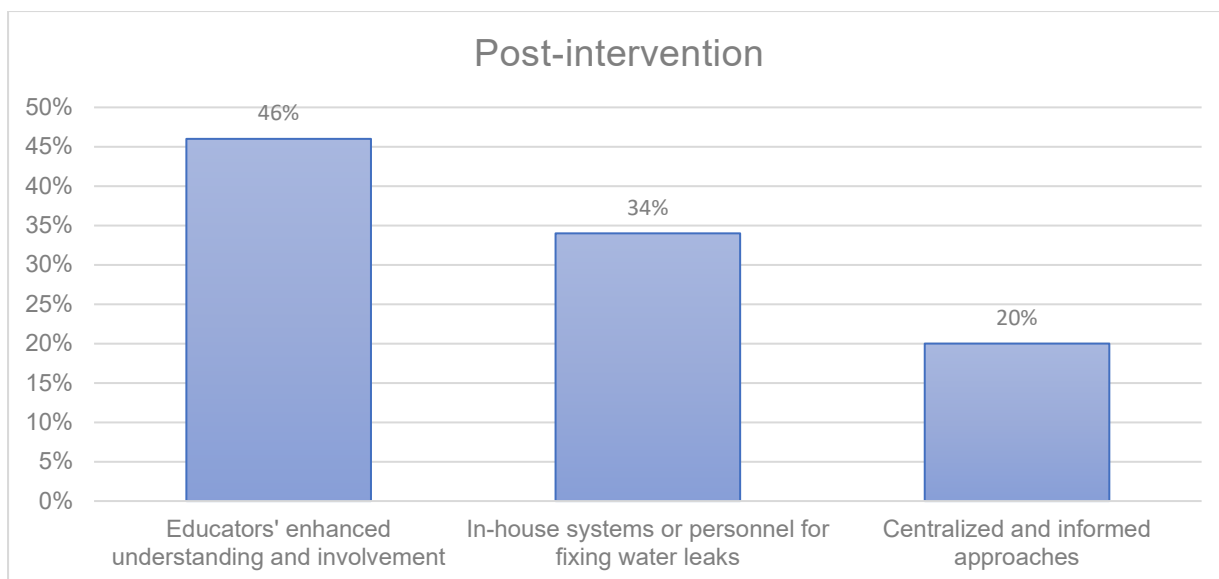
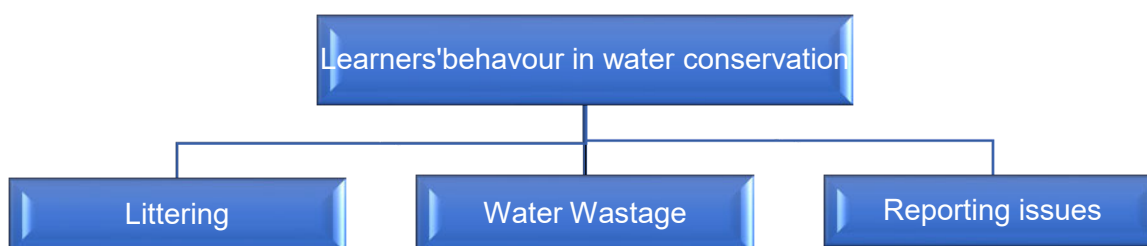


Figure 4.2.5.1.c: Schools management of water resources post-intervention.

Figure 4.2.6.a Theme 6: Learners' behaviour in water conservation



The behaviour of learners in water conservation shows several key aspects related to littering, water wastage, and reporting issues within the school environment. Littering appears prevalent, with observations of papers scattered across the school premises after breaks (Figure:8), the learners indicate that the dustbins are scarce, showing a need for improved waste management infrastructure. Moreover, the constant mention of leaving taps running suggests a prevalent behaviour among learners, contributing to water wastage. This is evidenced by the following quotes:

“During break they do litter, but they pick up after break time and they litter because there are not enough bins.” (Educator B, School, B)

“Mostly during break/lunch time some learners do litter, but they are taught to use the bins and also to pick up litter after break.” (Educator M, School, C)

“Some do not use water bottles to drink water they use their mouth and hands which wastes water”. (Educator L, School, A)

“They use their hands to drink water by the running taps” (Educator O, School, B)

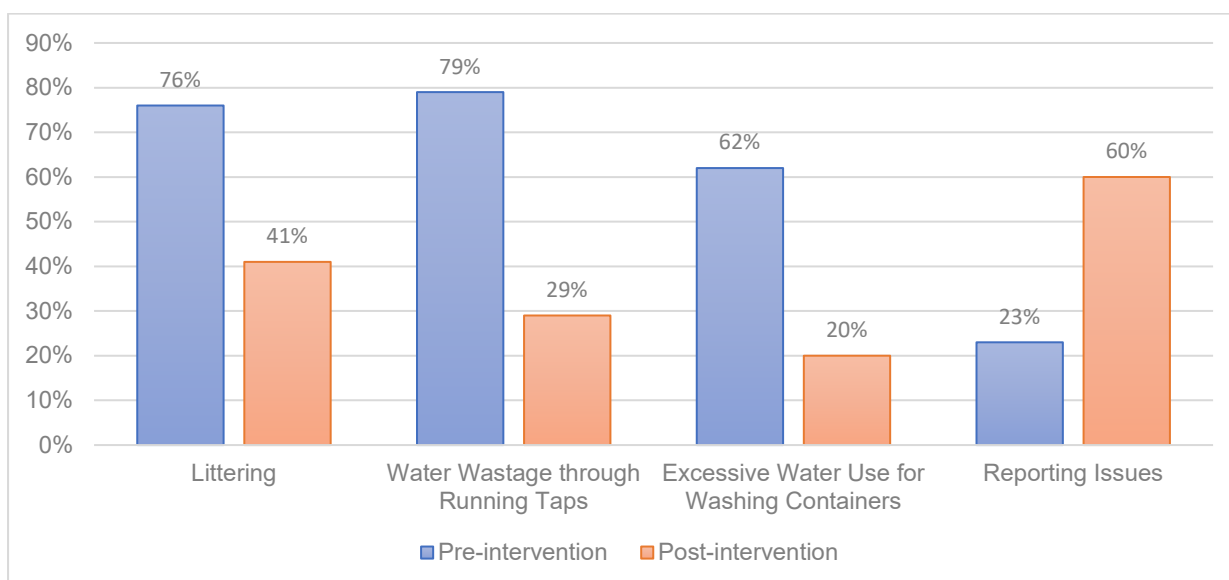
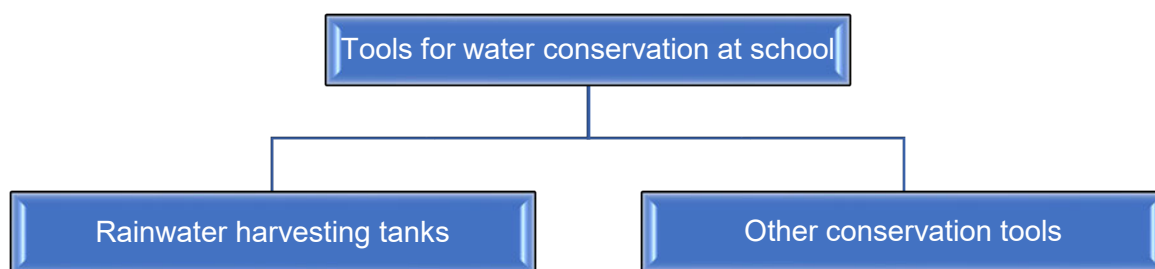


Figure 4.2.6.1.b: Learner’s behaviour in water conservation.

This behaviour continues regardless of some awareness of the issue, as mentioned in occasions where learners are observed leaving taps running and not closing them. The link between using excessive water to wash containers after breaks suggests a need for more efficient water use practices among learners. However, there is a lack of explicit responses from the educators concerning reporting issues associated with water conservation, showing a potential lack of awareness among learners regarding reporting water-related problems within the school environment. Overall, the findings suggest a need for initiatives to address littering, water wastage through running taps, and promoting a culture of water conservation among learners, potentially highlighting the significance of reporting water-related issues for effective conservation practices within the school.

Figure 4.2.7.a Theme 7: Tools for water conservation at school

School's management of water resources



The study reveals different levels of implementation and understanding regarding tools for water conservation at school, specifically regarding rainwater harvesting tanks and other conservation tools. Some educators recognise the presence and functionality of water storage tanks particularly designated for water conservation purposes, showing a proactive approach to save water. This is evidenced by the following quotes:

There are water tanks at school but I'm not 100% sure, they use water from the rain (Educator K, School, B)

There are water tanks at the back of the library, the water is sometimes used when we have a water shortage for flushing toilets. (Educator F, School, A)

Yes, we have JoJo tanks that we use to save water. (Educator G, School, C)

In addition, there is recognition of using these tanks for flushing toilets during water scarcity, showing a practical application of stored water. Moreover, there is mention of specific approaches taken to conserve water, for instance reporting leaks, preventing water wastage, collecting water in bottles, and utilising strategies like the “tight water tap strategy.”

The water wise kids report toilets, water pipes and taps leaking to general workers. (Educator C, School, A)

However, there were a few responses which showed a lack of awareness or denial of any such tools or practices within one of the schools.

“I am not aware of the strategies at our school that are used for water conservation” (Educator M, School, B)

Interestingly, there is a mention of some learners who actively engage in educating others about water conservation, potentially showing a grassroots effort among learners to promote water-wise behaviours.

“There are some learners at our school who are actively involved in teaching others about water conservation” (Educator L, School, C)

Overall, although participants demonstrated a clear understanding and utilisation of rainwater harvesting tanks and other tools for water conservation, others show a lack of awareness in such practices, highlighting potential differences in implementation or understanding across the three schools.

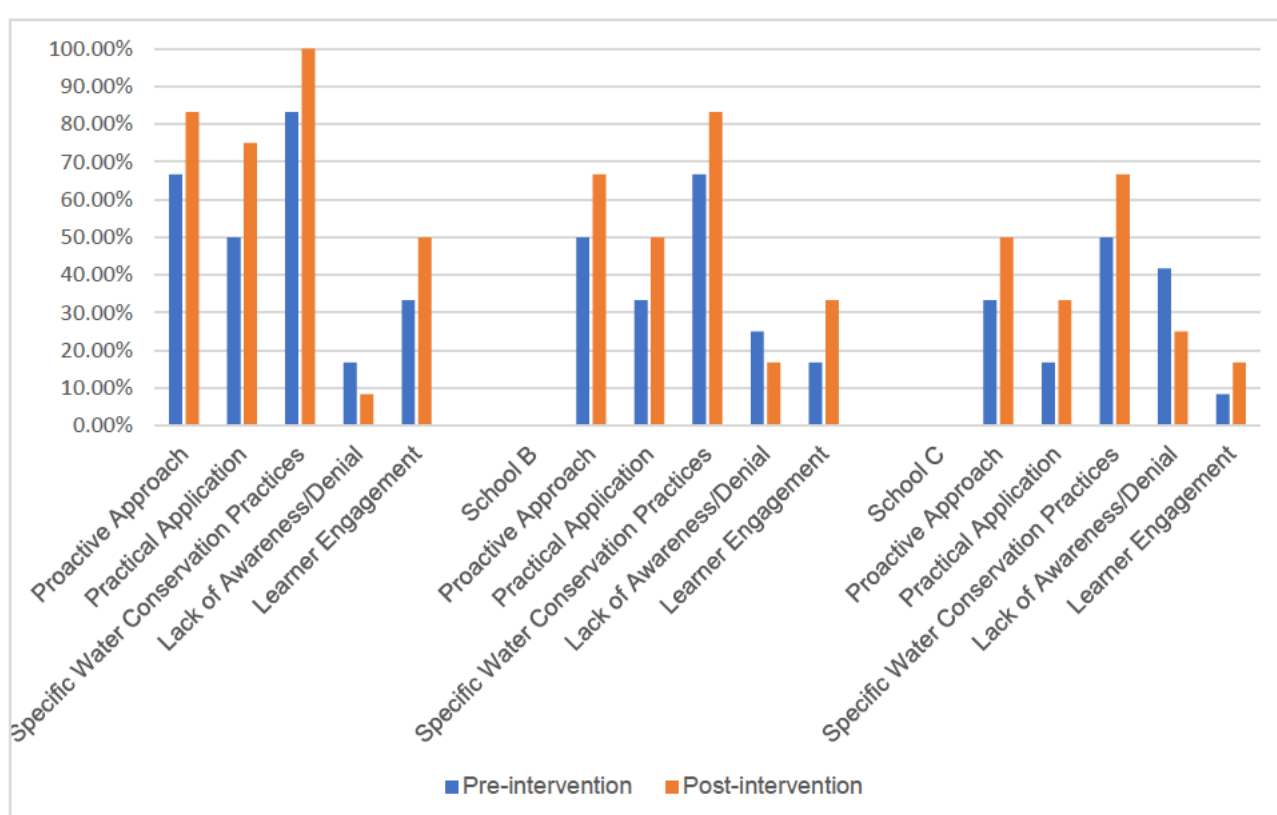
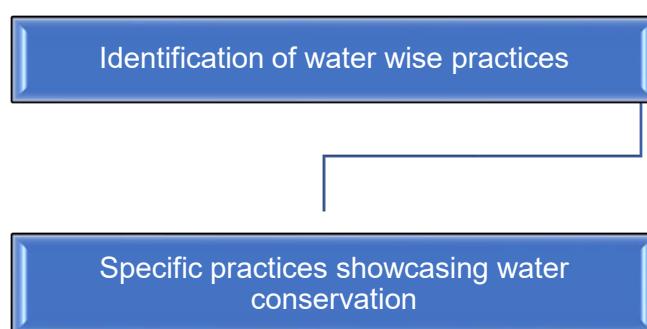


Figure 4.2.7.b: Tools for management of water across the three schools, pre and post the intervention.

Figure 4.2.8.a **Theme 8: Identification of water wise practices**



The study findings provide perspectives into specific practices observed within the school environment that show water conservation practices among learners. Some identified practices include the use of lunch boxes *“Some learners use their lunch boxes to drink water”* (Educator E, School, C) or squeeze bottles for drinking water, *“Some are now using squeeze bottles, and not hands at the tap”* (Educator J, School, A) demonstrating a change from potentially wasteful practices such as using hands directly at taps.

The act of storing water in personal water bottles indicates a proactive approach to conserving water for later use. Moreover, there are observed trends of reporting water leakages and utilising strategies like the “tight water tap strategy,” indicating deliberate efforts to prevent preventable water wastage. *“They store water in their water bottles. They report any water leakage. They practice tight water tap strategy.”* (Educator D, School, C)

Additionally, the mention of some learners who are educating other learners about water conservation shows a peer-to-peer education initiative within the schools, further promoting water-wise behaviours. *“Learner C, Learner G and Learner K, they teach each other as school children on how to be a water wise”* (Educator G, School, B)

However, there are also responses indicating a lack of specific practices or actions related to water conservation among specific individuals or groups. Overall, these responses demonstrate a range of actions taken by learners, from personal practices to collective efforts, showing a range of water-wise behaviours within the school environment.

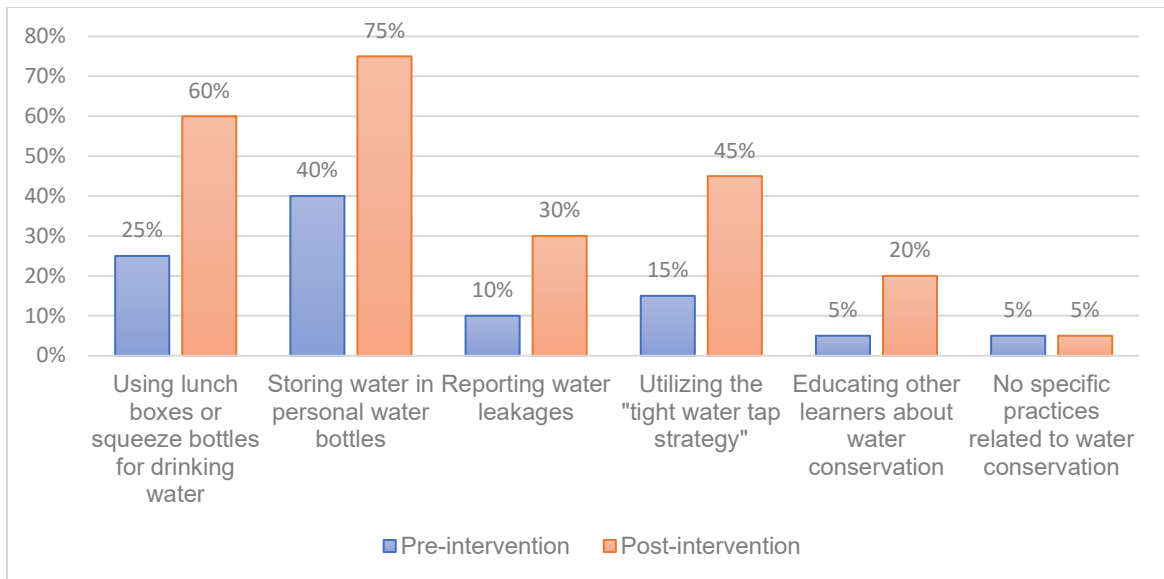
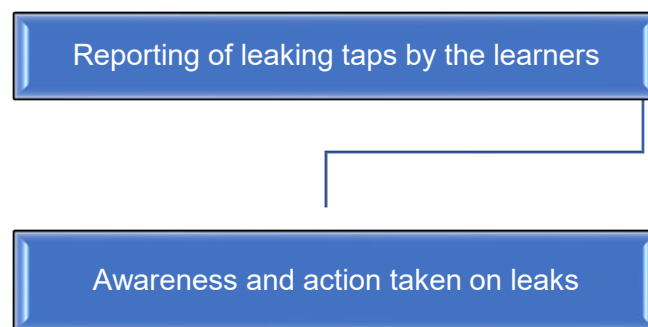


Figure 4.2.8.b: Identification of water wise practices.

Figure 4.2.9.a Theme 9: Reporting of leaking taps by the learners



The findings concerning learners reporting leaking taps highlight different levels of awareness and action taken on leaks within the school environment. Some educators observed a proactive approach among learners, citing that learners report leaking toilets, water pipes, and taps either to the educators, maintenance personnel, or general workers as evidenced in the following quotes:

"They report to the educators or general workers". (Educator M, School, A).

"The water wise kids report toilets, water pipes and taps leaking to general workers". (Educator G, School, A)

This indicates an understanding among certain individuals that learners are actively involved in identifying and notifying responsible people on water-related issues. Furthermore, there were some responses that highlighted the significance of showing this awareness to the Water Wise Programme, indicating a desire to reveal the schools' ability to address their own challenges.

“So that even Water Wise arrive they can see that we know how to solve our problems”. (Educator B, School, C)

However, contrasting these, were a few responses which indicated a lack of awareness of any reporting activities by the learners. These inconsistencies might indicate a potential gap in uniformity regarding the understanding of learners reporting leaks, suggesting a need for further exploration to ascertain the actual extent of learners' involvement in reporting water-related issues within the school environment.

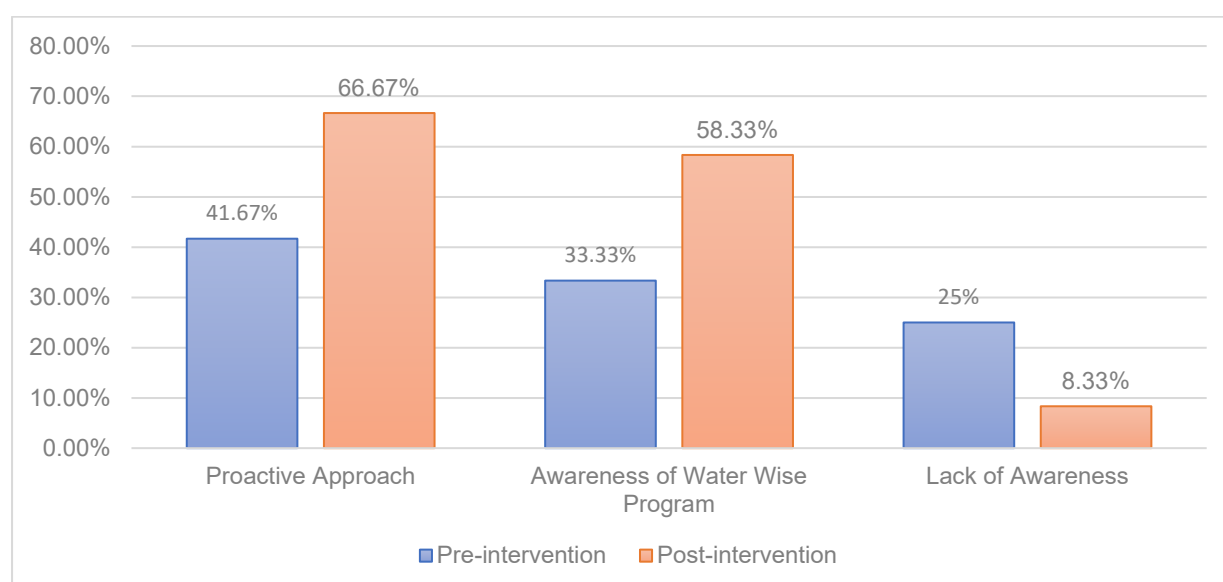
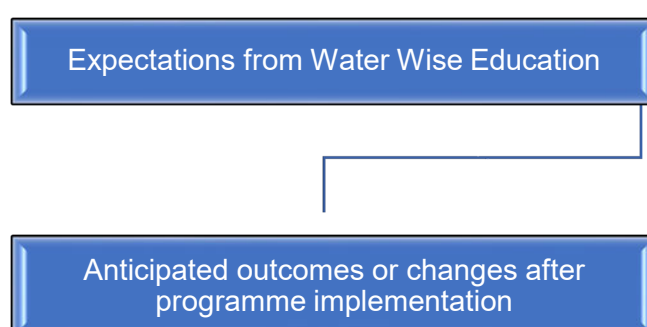


Figure 4.2.9.b: Reporting of leaking taps by the learners.

Figure 4.2.10.a Theme 10: Expectations from Water Wise Education



The study shows a range of expectations before the Water Wise Education intervention and perceived outcomes after the intervention. At the beginning, expectations were different, ranging from expecting fresh ideas to preserve water and a desire to acquire more knowledge and skills on water conservation for both educators and learners. Some participants projected gaining insights and wisdom from the Water Wise Programme, anticipating learning from the accumulated knowledge of the programme. Post-intervention, the findings indicate a slightly positive alignment between expectations and outcomes. There is a sense of fulfilment, with participants expressing satisfaction with the knowledge and skills acquired, particularly highlighting learners' accumulated knowledge and skills on dealing with leaking taps. Additionally, there is confirmation that the Water Wise Programme successfully imparted knowledge and knowledge, fulfilling the expectations set beforehand. Overall, the findings suggests that to some extent the Water Wise Education Programme met the initial expectations, providing some valuable perspectives and practical knowledge on water conservation for both educators and learners.

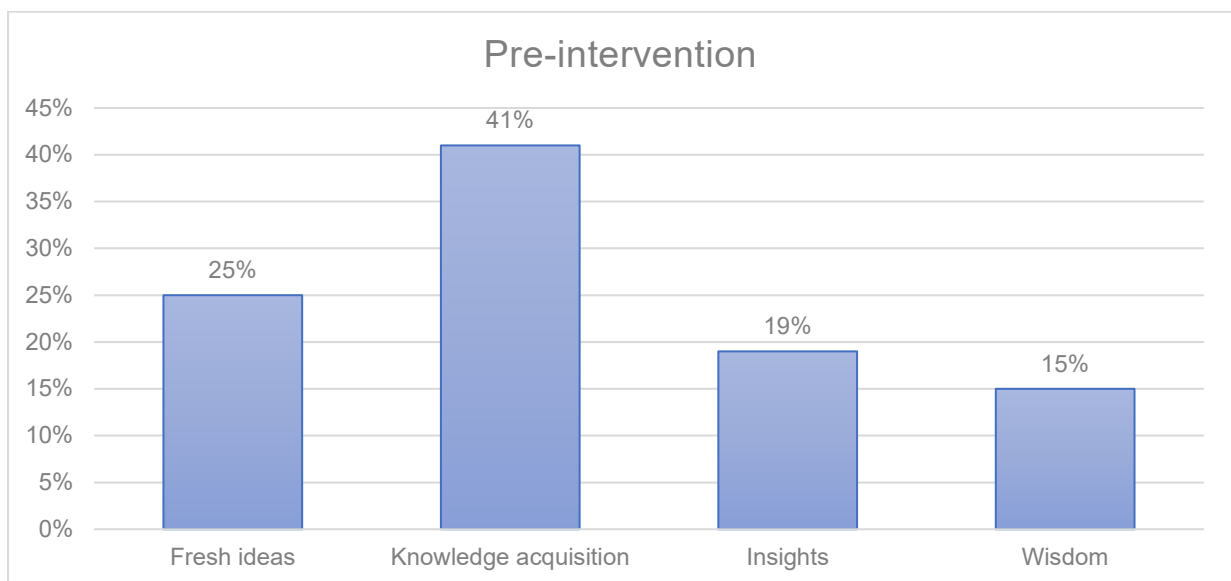


Figure 4.3.1.b: Educators expectations from the water wise programmes.

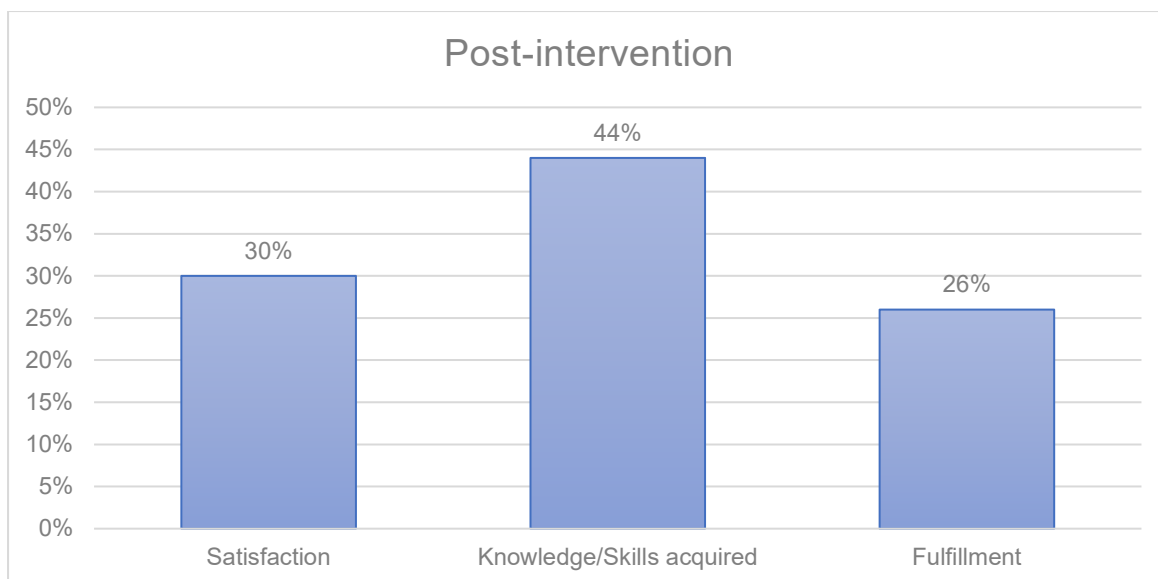


Figure 4.3.2.c: Educators' expectations of the Water Wise programme post-intervention.

4.4 Findings based on learners' responses

Section 4.4.1 presents the findings based on the data that was obtained from the learners.

4.4.1 Learners reflections of Water Wise Programme

The participants narrated a comprehensive array of experiences during the Water Wise Programme that were based on the fundamental notion of using water wisely. The sessions comprised of several methods of engagement, involving demonstrations, discussions, drama presentations, and practical guidance. They underscored the importance of water in people's daily lives, highlighting responsible use of water and the potential consequences of wasteful practices. Through the involvement of representatives from Rand Water, the Water Wise Programme revealed the significance of water conservation, even providing tangible aids like water storage tanks for access while taps were being repaired. Participants were exposed to multiple facets of water conservation, ranging from fixing leaking taps to acquiring knowledge about water treatment. This is evidenced by the following quotes:

"I remember the water wise programme teaching us how to fix a leaking tap."
(Learner G, School, B)

“They were telling us how important water is in our lives and we must use water wisely.” (Learner A, School, C)

“They were giving us information about water; they were telling us that water is very important in our lives” (Learner C, School, A)

“We learned about how to treat water and how to fix a tap during a leak.” (Learner G, School, A)

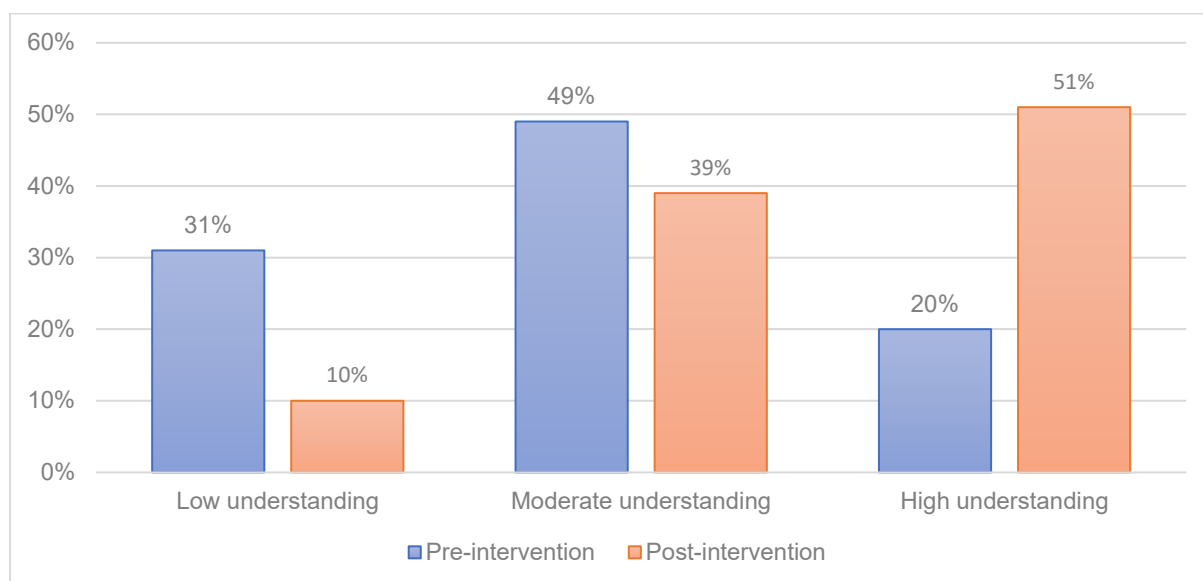


Figure 4.4.1: Learner's awareness of the Water Wise programmes.

4.4.2 Understanding of Rand Water

The learners view Rand Water as an organisation that teaches and regulates water usage, operating as a facilitator in water conservation initiatives. There is a general understanding that Rand Water is an organisation or programme that focuses on educating the public about wise water usage, highlighting the significance of using water wisely without wastage or pollution. Most learners recognise the role of Rand Water in water allocation, attributing it to providing clean water to Gauteng and other provinces, with a strong emphasis on purifying polluted water to ensure clean supply of water. Some descriptions highlight the educational aspect, mentioning how Rand Water educates people on water conservation practices, teaches on fixing leaks, and even addresses the cleaning process for both the environment and potable water.

“Rand water is a company that teaches us about how to fix leaking taps and how to conserve water at school” (Learner A, School, B). Furthermore, the participants

acknowledge that Rand Water is involved in providing water to households and communities, either directly or through distribution networks, and that it is an organisation that either sells or supplies water across South Africa.

“Rand Water is a company where people help us to get water” (Learner A, School, B)

“It distributes water into certain areas, clean water” (Learner A, School, B)

“Rand Water is a company that produce us with water” (Learner A, School, B)

“Rand Water gives us water in our homes so that we can have water and supplies them to areas” (Learner A, School, C)

Overall, the findings show Rand Water as an organisation that is devoted to supplying clean water, educating the public on water conservation, and carrying out purification processes to ensure safe and accessible supply of water.

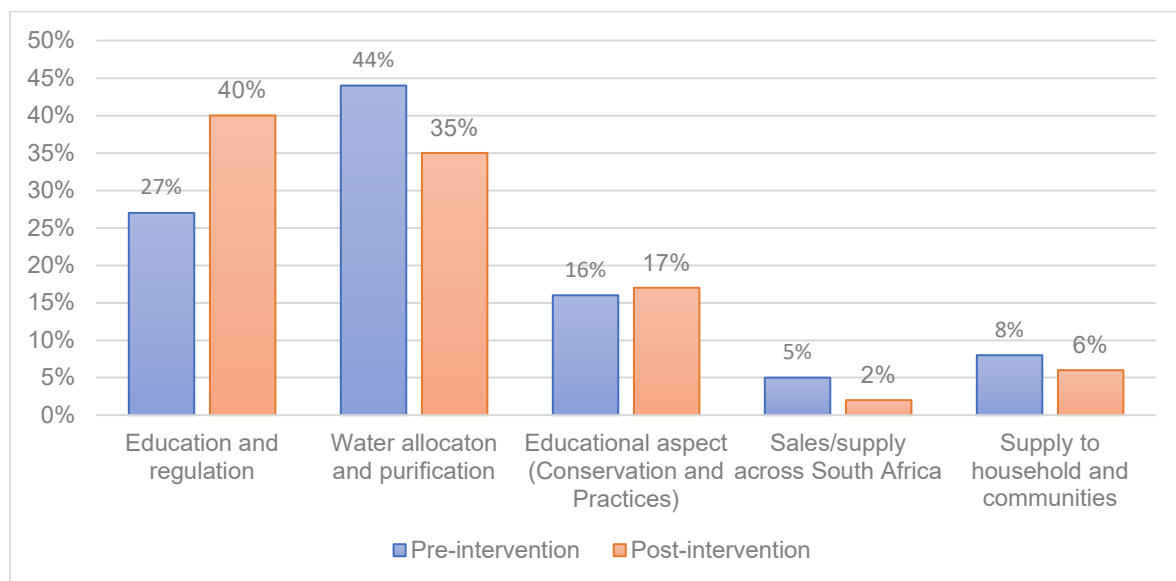


Figure 4.4.2.a: Learner's understanding of Rand Water pre and post intervention.

4.4.2 Water-wise behaviour and understanding

The study findings demonstrate a diverse understanding of what it means to be Water Wise. Fundamental to this theme is the idea of using water wisely and responsibly. During the programme there is a consistent emphasis on the significance of using water wisely and not wasting it. The learners acknowledge the importance of actions

for instance turning off taps whilst brushing teeth or bathing to save water. There is a clear association between being Water Wise and using water in appropriate quantities for daily activities. This understanding includes proactive behaviours such as using a plug when cleaning dishes or closing taps that are left open. Furthermore, there is a predominant sentiment of care and respect for water, shown in the idea of treating water wisely and not wasting it even when confronted with open taps. The learners associate being Water Wise with understanding water usage, being vigilant about leaks, and actively retaining behaviours that safeguard and conserve water. Overall, being Water Wise, as understood by the participants, involves a responsible and considerate approach to water usage, involving both practical conservation actions and an attitude of respect and care for this key element of life.

“To be water wise means taking care of water in your environment because when people wash hands, they leave the taps running, making the environment wet” (Learner H, School, B)

“It means that you have to take care of water like when you bath or use a bathroom.” (Learner H, School, B)

“It means how is your water usage, it means you are protecting water when you are using it” (Learner A, School, A)

“To close taps when they are open don’t open water and leave it open” (Learner B, School, C)

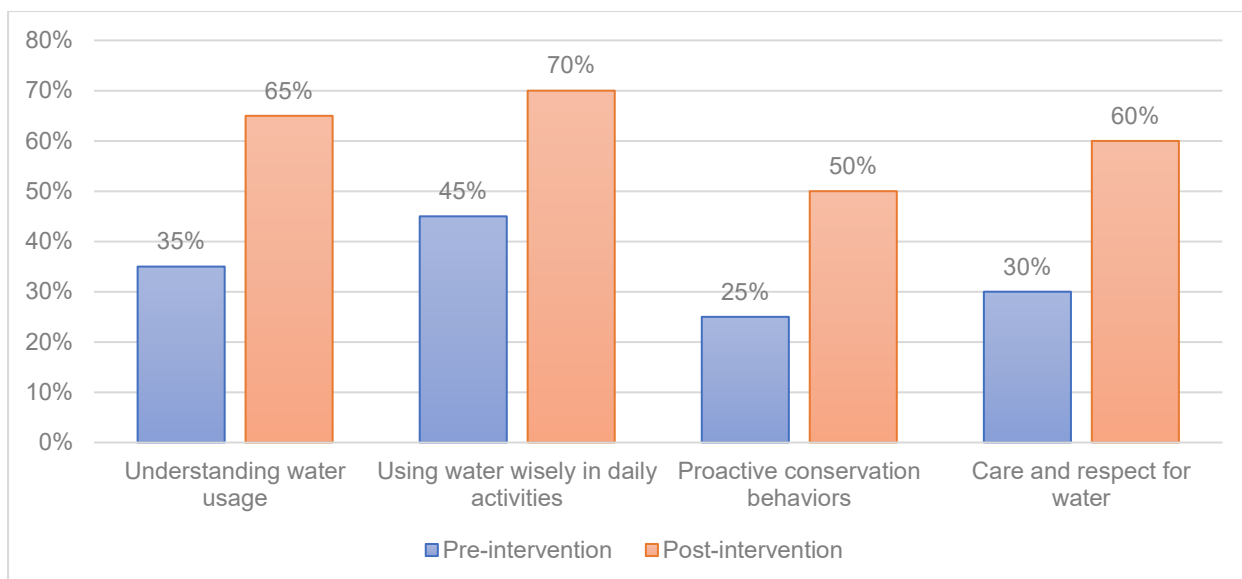


Figure 4.4.2.b: Water wise behaviour and understanding.

4.4.3 Knowledge and actions related to water conservation.

This theme relating to knowledge and actions associated with to water conservation, emerges prominently from the data. Learners clearly remember the educational aspect of the Water Wise Programme, highlighting lessons imparted about responsible water usage both at school and at home. Fundamental to this theme is the consistent highlight on using water wisely because of the awareness that certain communities struggle with water scarcity. Participants narrated specific instructions for instance not wasting water whilst brushing teeth or washing, always closing taps to avoid wastage, and observing to designated amounts of water for activities as bathing or dishwashing.

"They told us a lot, you know? Like, don't let the tap run while brushing your teeth, always close the tap tight to avoid wastage, and use the right amount of water for things like bathing or washing dishes." (Learner H, School, B)

There is a clear link made between responsible water usage and the broader context of availability of water for others, emphasising the significance of conservation.

"It's not just about saving water for ourselves; it's about understanding that water is precious, and some places don't have enough. The program helped us to understand that. It's not just a tap; it's a resource, and we have to use water wisely." (Learner B, School, C)

Practical demonstrations, for example a play demonstrating water-wise practices and instructions on fixing leaking taps, were integral parts of the Water Wise Programme, empowering learners with actionable knowledge on water conservation practices and the significance of using water wisely and responsibility.

“We had this play showing water-wise practices, and they even taught us how to fix leaking taps. It was so real, like we had done something.” (Learner A, School, A)

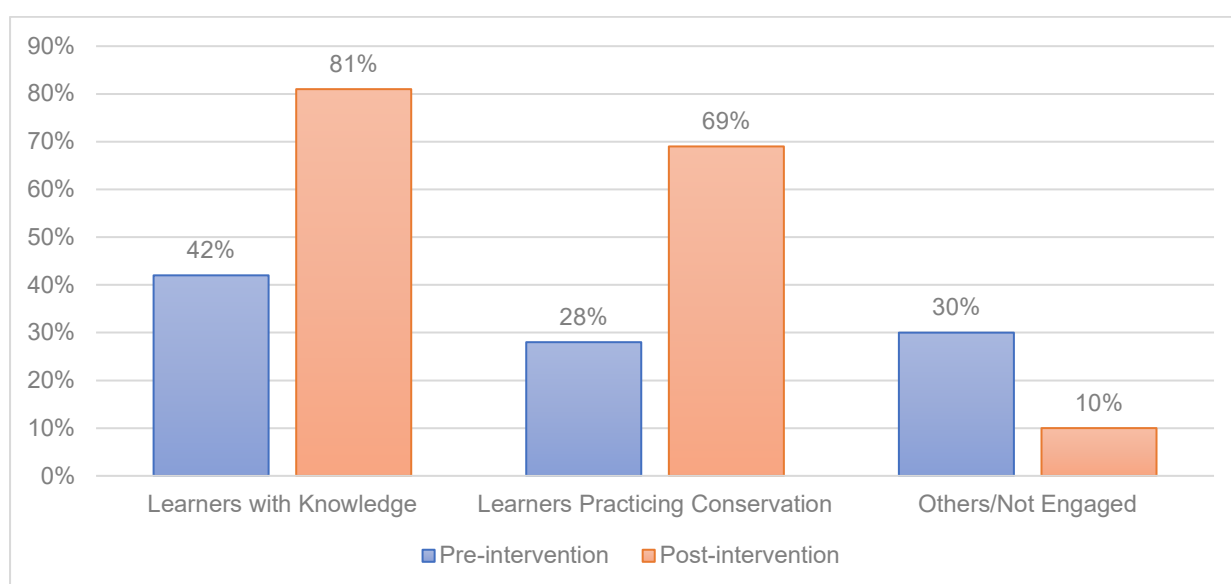


Figure 4.4.3: Knowledge and actions related to water conservation.

4.4.4 Water sustainability at school

The study findings indicate a clear understanding that a leaking tap creates problems not only in terms of water wastage but also probable dangers, that requires adult intervention because of safety concerns for children. The consensus among learners is that water is a precious resource that should not be consumed without reason, specifically considering the scarcity of clean water for many communities. There is a shared sense of responsibility to report leaks quickly to prevent avoidable water loss, indicating the importance of conserving water for necessary purposes *“Because leaving it means that you do not care about making the environment wet”* (Learner J, School, A).

“Because if I leave the tap leaking means I am not water wise” (Learner F, School, C).

The learners underscore the significance of adults in fixing such issues because of their perceived expertise and skills, and the belief that water must not be wasted for insignificant reasons. The idea of water scarcity and the necessity to preserve water for communities emerges consistently throughout the study findings, driving the need to act and prevent waste at the school level to contribute to water conservation initiatives.

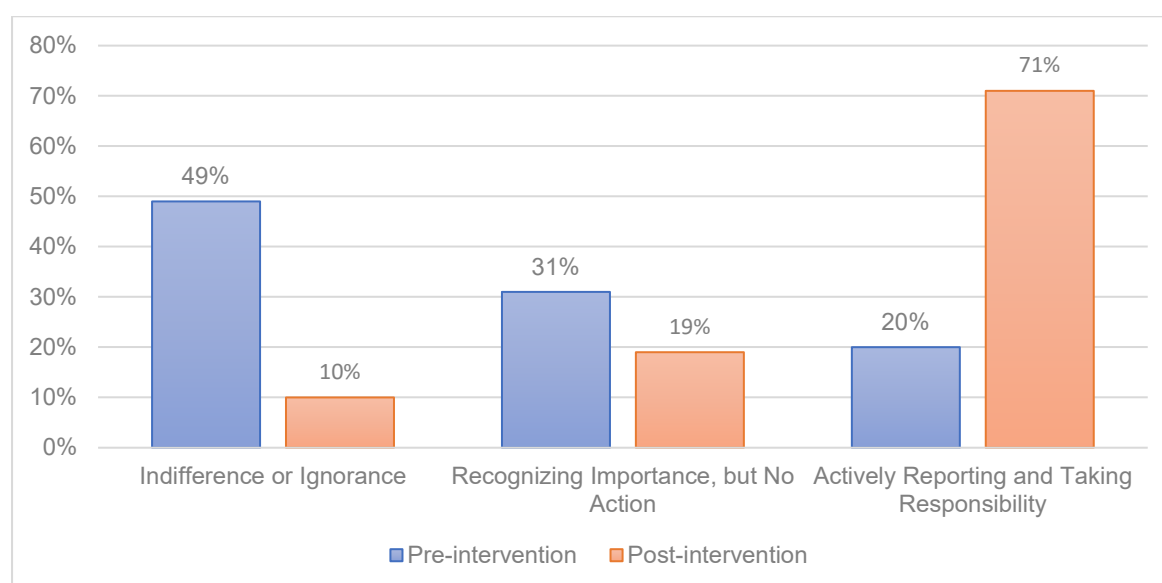


Figure 4.4.4: Water sustainability at school.

4.4.5 School-level changes for water conservation

The findings based on establishing changes within the school environment for water conservation, emerges vividly from the data collected. Suggestions by the learners include making sure taps stay closed to promote water-wise behaviour and hygiene,

"We see a lot of taps were left open. It's a simple thing, but it wastes so much water". (Learner D, School, C).

Providing plastic cups or bottles for drinking water to prevent wastage, and imparting knowledge about responsible water use to prevent unnecessary consumption.

"Learners all need to have bottles so we can all be water wise". (Learner L, School, A).

Several participants stress the need for education and guidance on water conservation, advocating for initiatives that involve educating learners about water-

saving activities and discouraging littering to prevent water pollution. Learners indicated the need for supervision, signifying the presence of guardians to instruct learners on appropriate water use, remind them to close taps, and encourage the use of bottles for drinking to reduce hand wastage.

"Maybe we need supervisors. They can guide us on appropriate water use, remind us to close taps, and encourage the use of bottles to reduce hand wastage." (Learner K, School, C).

Overall, the findings stress a collective desire for practical measures, educational programmes, and supervision aimed at promoting a water-wise culture within the school environment, involving both behavioural changes and resource management approaches.

"We need to change and do things differently and someone to guide us – that's what will make us know how to save water in our school." (Learner L, School, C).

"We must teach other learners how to drink water and use bottles or cups" (Learner G, school A)

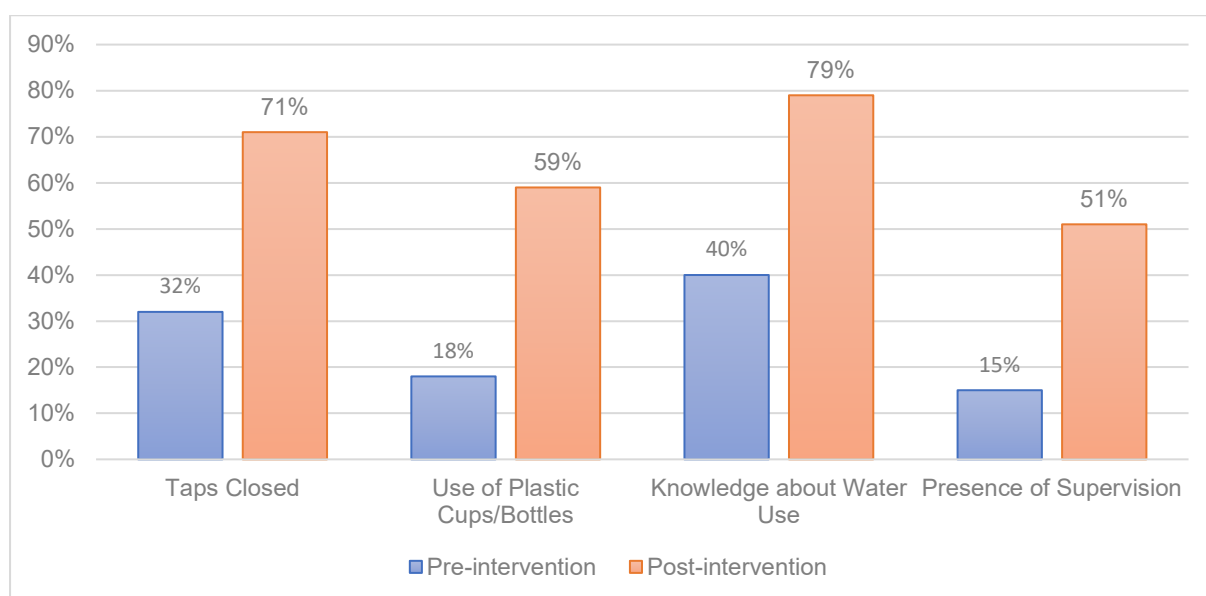


Figure 4.4.5: School-level changes for water conservation.

4.4.6 Understanding water systems and pollution

There is a contradiction apparent: a contradictory perspective where learners, after consuming food, choose to throw papers on the ground instead of using bins,

regardless of being taught by Rand Water representatives about maintaining cleanliness. The reasoning behind this behaviour differs; some attribute it to the lack of a direct understanding of litter's harmful impact on health and the environment.

"Some learners know how bad litter can be to our health and the environment. Even though we were taught about it, it is not everyone who knows the danger of litter." (Learner L, School, C).

There is also an element of convenience, with learners mentioning distance from bins as a reason for littering, despite the availability of rubbish bins.

"It's not that we don't want to use bins, Learners are lazy to throw litter in the bins." (Learner J, School, C).

Moreover, a sentiment emerges that some learners believe that it is the responsibility of hired personnel to do the cleanup, suggesting a disconnection between personal responsibility and collective ownership of the school environment.

"I think some of us think it's not our job to pick up litter. We see the cleaning people around, and we think they here to do that, not us." (Learner N, School, B).

Furthermore, the problem goes beyond littering to include wasteful water practices, with cases of leaving taps running after use, possibly due to carelessness or oversight. Overall, these findings paint a picture of attitudes ranging from indifference to justification for littering behaviour, showing a complex interaction of understanding, convenience, and responsibility towards maintaining a clean and sustainable school environment.

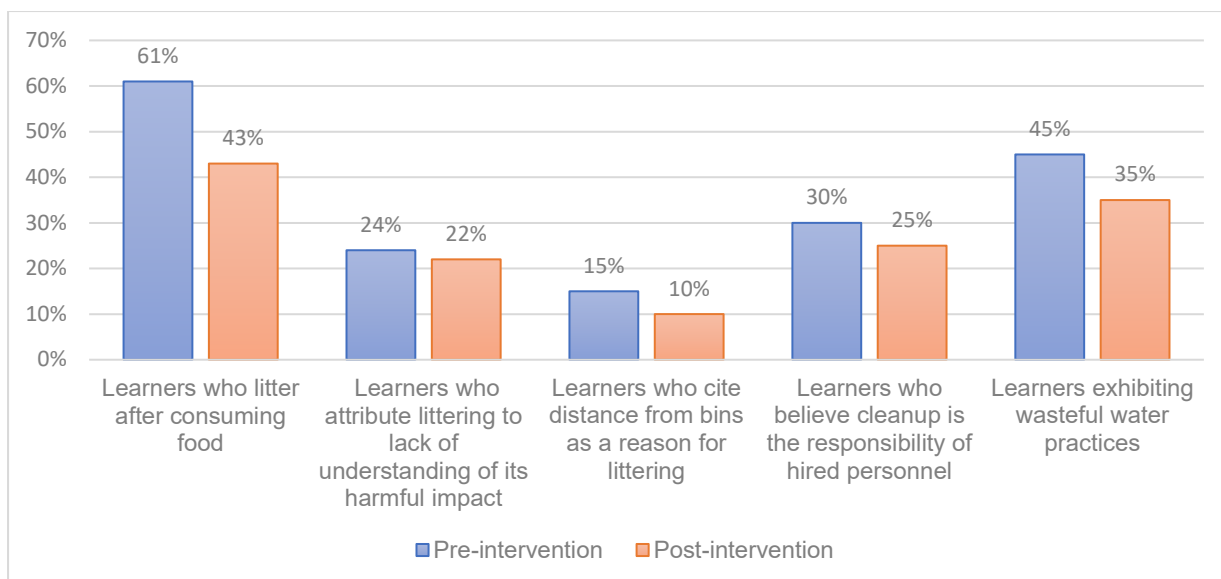


Figure 4.4.6: Understanding water systems and pollution.

4.4.7 Attitudes toward water reuse and payment

Learners expressed concerns about the potential health risks associated with dirty water, highlighting the relationship between dirty water and diseases. They acknowledge the need to purify reused water by boiling it to remove germs, highlighting the process of recycling water to make it fresh again.

"Dirty water is a serious problem for us because we know it can cause diseases. We need to be careful about what we drink to stay healthy." (Learner O, School, A).

"We were taught that if we boil reused water, it kills germs, and we can make it fresh again. It's like recycling water to make it safe for drinking." (Learner H, School, B).

The study findings highlight the urgency of conserving water due to its potential scarcity, implying that saving water is both a responsibility and a necessity. Individuals recognise that not reusing water can lead to wastage, stressing the need to conserve this vital resource.

"Wasting water is something all learners should avoid. Not reusing water means wastage, and we understand the importance of water is good". (Learner I, School, C).

Learners stress that clean water is essential for health, indicating the risk of illness from drinking dirty water. There is an acknowledgment that while reusing water is beneficial for conservation, precautions must be taken to ensure it does not have germs before use, strengthening the idea that clean water is crucial for overall well-being.

“Clean water is good for our health. Drinking dirty water can make us sick, and that’s something we all want to avoid.” (Learner M, School, A).

The theme further discusses the reasoning for paying for water and the interconnectedness of water usage, cleanliness, and societal responsibility. The learners express the necessity of paying for water due to its crucial role in daily activities like washing clothes, dishes, and maintaining cleanliness both at home and in schools.

“We must pay for water because if we don’t, we will not get clean/fresh water” (Learner N, School, A).

“Because water is not free, and water is something that you cannot live without and should be saved” (Learner K, School, B).

Learners emphasise the need for clean water, considering it vital for survival and overall well-being, indicating that paying for water ensures access to clean water directly from taps. The idea of paying for water is also linked to supporting the systems that provide clean water, such as Rand Water or municipal services, highlighting the financial support needed for water treatment and purification. Furthermore, the learners note that paying for water promotes responsible usage and prevents water scarcity, especially given concerns about misuse or inadequate purification resources. The predominant sentiment is that paying for water is not just a personal obligation but a societal responsibility to guarantee equitable access to clean water for everyone in the community, supporting the infrastructure and processes required for its purification and allocation.

“So that the government can buy clean chemicals to clean water” (Learner O, School, A).

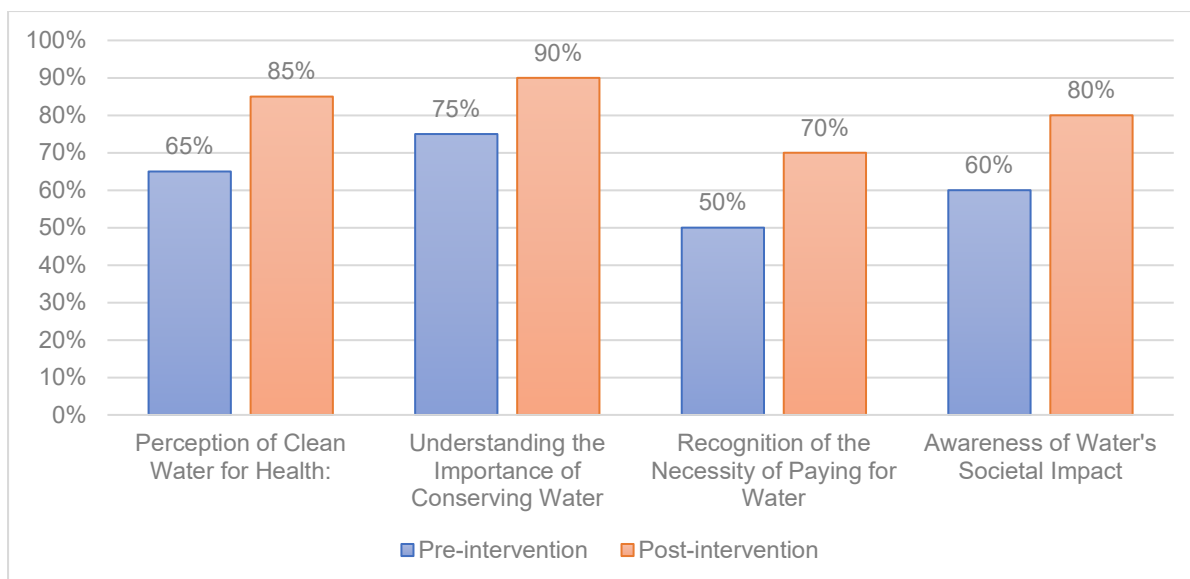


Figure 4.4.73: Attitudes towards water reuse and payment.

4.4.8 Understanding importance of water

The consensus among the learners highlights the crucial role of water in sustaining life itself. Water is repeatedly framed as a fundamental need, not just a want, underlining its pivotal function in several aspects of existence. Water depicted as the essence of life, *“Because water is life we cannot live without water”* (Learner G, School, A), essential for bodily functions, growth of plants and animals, and maintaining overall health. The study findings highlight the practical applications of water, from nourishment and cooking to hygiene and sustaining the ecosystem *“We cannot cook without water, we cannot live without water, and we cannot drink water”* (Learner O, School, B).

Furthermore, the consequences of water deprivation are outlined, stressing dehydration leading to the possibility of death. The multifaceted significance of water appears as a central theme, with an emphasis on its role in sustaining life, nourishment, hygiene, and overall well-being.

“Because we do everything with water, we cook and drink water” (Learner F, School, A).

“Because water is our basic need” (Learner L, School, C).

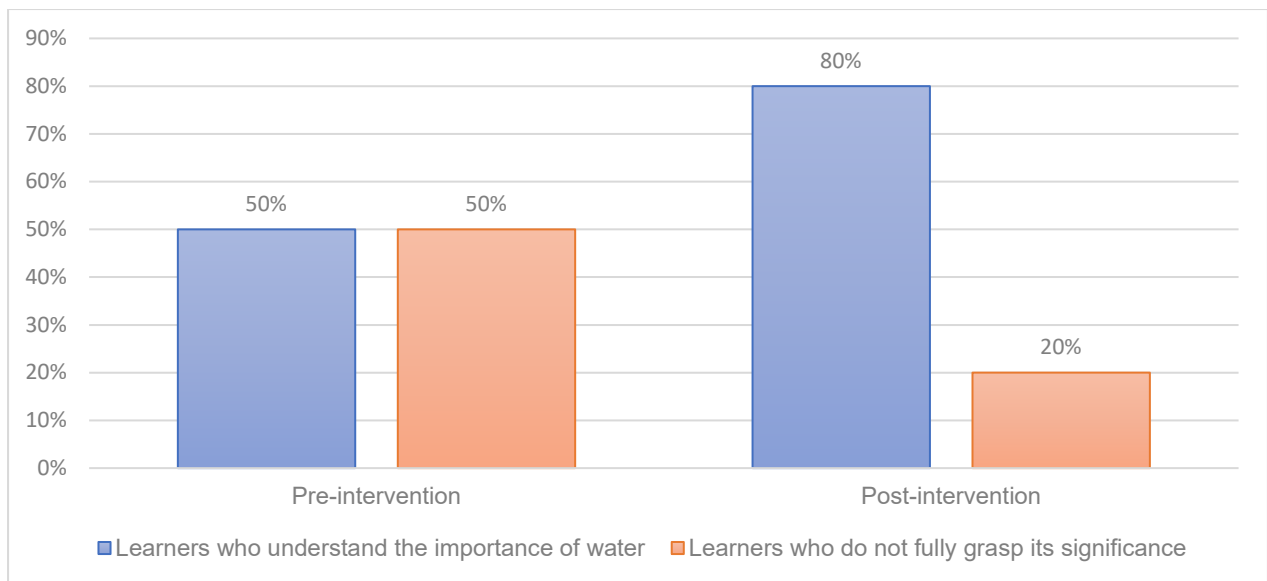


Figure 4.4.8: Understanding the importance of water.

4.6 Conclusion

This chapter has presented a comprehensive description of the study findings based on determining whether Rand Water’s Water Wise Education Team’s water conservation intervention programmes have the desired outcomes of improving water conservation practices in learners in schools located in high water demand areas within Rand Water’s area of supply. Through the systematic analysis of data obtained from the pre and post intervention self-administered questionnaires, several key themes and sub-themes emerged, shedding light on the multifaceted implications of this water conservation programme. Therefore, this chapter serves as a crucial bridge between methodology and substantive findings, underlining the complexities and the perceived impact of water conservation programmes within primary schools in South Africa.

CHAPTER 5: DISCUSSION

5 Introduction

This chapter presents a comprehensive discussion and synthesis of the findings from the study. The discussion delves into the complex aspects of the water conservation practices in three primary schools located in high water demand areas in Gauteng. The preceding chapters have laid the groundwork by examining different dimensions of water conservation practices in three primary schools, ranging from educators' knowledge and perceptions to the practical application of water conservation initiatives within the school environment. Through this synthesis, this chapter provides insights into the complexities, challenges, and opportunities inherent in water conservation practices within the school environment, highlighting the importance of these findings in fostering sustainable practices and informed decision-making in relevant areas.

5.1 Discussion of study findings

Theme 1 of the study findings is based on educators' knowledge and awareness of the Water Wise programme. The pre-intervention phase highlighted different perceptions among educators, ranging from considering the Water Wise Programme as a water purification entity to acknowledging its role in educational activities associated with water conservation. Post-intervention, there was a noticeable change towards a more refined and nuanced understanding of the Water Wise Programme's objectives, possibly indicating the programme's impact in clarifying misconceptions and improving perception. According to Zachariou *et al.* (2017) effective environmental education profoundly relies on educators' knowledge, attitudes, and practices. Several studies (Marcinkowski and Reid, 2019; Shutaleva *et al.*, 2020; Timm and Barth, 2021), stress the importance of educator awareness, not only in terms of factual knowledge but also in their attitudes and willingness to participate in environmental issues.

Furthermore, Timm and Barth (2021) underscore the impact of educator perceptions on the effective implementation of environmental education initiatives within schools. Salamondra (2021) adds that educators who understand the objectives and approaches of environmental programmes are more likely to successfully convey the intended messages to their learners. This aligns with the post-intervention findings suggesting a more coherent understanding among

educators, possibly because of the intervention's capacity to clarify and refine their perceptions of the Water Wise Programme.

In addition, the SES (Bronfenbrenner, 1979) suggests that educators serve as role models and influencers in shaping the learners' attitudes and behaviours. Educators who have a deeper understanding and positive attitudes towards water conservation initiatives are more likely to instil similar values on learners. Therefore, the change in educators' perceptions post-intervention towards a more aligned understanding of the Water Wise Programme could possibly influence their instructional methods and the information they deliver to their learners.

The second theme discusses the exposure of educators to the Water Wise Programme and its perceived impact on their knowledge, skills, values, and practices linked to water conservation. The findings suggest that even though educators acquired knowledge about water conservation, this knowledge does not consistently translate into changed behaviours, as shown by the continuous habit of leaving taps open despite learning about water conservation principles.

According to Hasan and Suciarto (2020), an individual's intention to execute a behaviour is influenced by their attitude toward the behaviour, subjective norms, and perceived behavioural control. Obtaining knowledge might influence attitudes, but it does not ensure changes in behaviour (Zhong *et al.*, 2019). There could be underlying obstacles such as habits, lack of perceived control impeding the translation of knowledge into action (Hasan and Suciarto, 2020). Simply obtaining knowledge about water conservation might not be enough without establishing implementation intentions, specific action plans describing how and when to enact the behaviour change. In this study it is possible that educators might lack clear strategies or plans to implement the knowledge they acquired into daily practices.

Behaviour change is complex and usually involves more than just knowledge acquisition (Hasan and Suciarto, 2020). Motivation plays a crucial role (Szymkowiak *et al.*, 2021). Educators might lack adequate motivation or incentives to regularly implement water conservation behaviours, specifically if these actions involve putting in effort or disturbing established routines. Studies (Burch *et al.*, 2019; Bradberry and De Maio, 2019) have shown that experiential learning, where people actively participate in the learning process, can yield more lasting behavioural changes. Merely imparting knowledge might not be as

effective compared to experiential learning sessions that trigger reflection and action (Bradberry and De Maio, 2019). Sustainable behaviour change demands a multifaceted approach involving experiential learning, continuous support, removing contextual barriers, and promoting a conducive social environment (Szymkowiak *et al.*, 2021). Integrating these perspectives into future Water Wise Programmes might assist close the gap between knowledge acquisition and consistent behavioural changes among educators.

Theme 3, involving household exposure to the Water Wise Programme, shows a huge gap between knowledge acquisition and practical application, aligning with the individual and household levels of the Social Ecological Model (SEM). This gap suggests that the intervention might not have adequately addressed the challenges hindering behavioural changes at the household level. Literature within the SEM highlights the complex interplay between individual knowledge, behaviour, and the wider environmental context (Chaudhary, *et al.*, 2017). For example, at individual level, the SEM suggests that interventions concentrating mainly on knowledge may not effectively translate into behavioural changes if they are not strengthened by enabling environments or community involvement (Thakur *et al.*, 2022). The current study findings show that even though increased knowledge about water sources, purification methods, and tap maintenance, observed behaviour for instance leaving taps running show a gap between knowledge and application. This indicates the need for interventions focussing not only on individual awareness but also the creation of supportive environments that enable and strengthen required behaviours. Literature within the SEM underscores the significance of considering the broader contextual factors such as social, cultural, and environmental (Partelow, 2018; EL-Nwsany *et al.*, 2019) that influence individual behaviours, highlighting the need for holistic interventions that address multiple levels within the SEM to encourage sustained behavioural changes in household water conservation practices (Addo *et al.*, 2019).

Theme 4 is premised on the educators' understanding of water meters and payment reasoning, highlighting the limited impact of the Water Wise Programme on improving this specific aspect of knowledge among educators. This finding aligns with the Socio-Ecological Model (SEM), which suggests that behaviours are influenced by multiple connected levels individual, interpersonal, community,

and societal (Partelow, 2018; EL-Nwsany *et al.*, 2019). In this context, educators' understanding of water meters and payment systems signifies an individual-level factor affected by different higher-level influences. The limited understanding might emanate from systemic issues for instance the complexity of municipal water systems, ineffective community engagement, or inadequate educational resources regarding water infrastructure. At the interpersonal level, educators' knowledge might be shaped by the exchange of information and social networks within their communities (Partelow, 2018). Community-level factors such as the comprehensiveness of the Water Wise Programme, including its teaching approaches or the level of engagement with community leaders, could impact educators' understanding. Societal aspects, including policies, infrastructure accessibility, and the general populace's awareness of water conservation practices, also influence educators' perceptions. For successful implementation of an intervention, there is a need to consider a holistic approach that focusses on educational gaps while bearing in mind the wider systemic and contextual aspects within the SEM to promote a more comprehensive understanding of water conservation practices among educators. Integration of educational initiatives with community engagement, policy developments, and infrastructural improvements could be indispensable in realising more effective and sustained changes in educators' understanding of water-related systems and payments.

Theme 5 is based on the schools' management of water resources, demonstrating a change from decentralised, ad hoc systems towards a coordinated, informed approach to water conservation post-intervention. This is consistent with the community level of the Social Ecological Model (SEM), where schools represent micro-communities. Pre-intervention, schools exhibited proactive measures but lacked systematic approaches for water conservation, depending on external assistance for leak fixes and educators' supervision of water usage. However, post-intervention, there was evidence of a coordinated and centralised approach, suggesting the Water Wise Programme's influence on fostering a comprehensive framework for water conservation. The change from ad hoc solutions to a structured approach indicates an intervention effect at the community level, influencing school policies and practices regarding water conservation. This resonates with the SEM's concept of reciprocal determinism, demonstrating how individual behaviours and environmental factors (in this study, educational interventions) interact to influence community-level practices, thereby influencing

the wider social context of water conservation within school environments (Abu Bakar *et al.*, 2021)). Studies supporting the SEM (Gonzales and Ajami, 2017; Quintana *et al.*, 2021), emphasise the importance of community-level interventions in influencing behavioural changes, highlighting the interconnectedness between individuals, their environments, and the larger community in adopting sustainable water conservation practices (Partelow, 2018). Therefore, the change observed in school management of water resources shows the Water Wise Programme's impact in promoting collective changes and structured methods for water conservation within micro-communities, aligning with the SEM's emphasis on multiple levels of influence on behaviours.

Theme 6, focusing on learners' behaviour in water conservation, involves the complex dynamics of behaviour change within the school environment. The findings showed prevalent issues for instance littering and water wastage among learners, demonstrating the need for interventions at different levels. At the individual level, learners showed behaviours like leaving taps running despite some awareness of water conservation, emphasising the gap between knowledge and practice. Interpersonally, peer influence played a role, evident in observed behaviours like too much water use for cleaning containers after breaks, implying the need for peer-to-peer education initiatives. Community-level factors, including inadequate infrastructure for example insufficient dustbins leading to littering, highlight the importance of environmental support systems. At societal level, there is a need to promote a culture of reporting issues for effective water conservation and solid waste management, aiming towards broader societal norms and educational approaches. Literature (Zhong *et al.*, 2019; Hasan and Suciarto, 2022) highlights the complexity of behaviour change, stressing the significance of multi-level interventions aligning with SEM to create sustainable changes in water conservation behaviours among learners within school environments. This aligns with studies emphasising SEM's function in understanding and addressing behaviours within complex systems, advocating for interventions across different levels to promote sustainable change in water conservation practices among young people.

Theme 7 discussed the tools for water conservation at schools, revealing different levels of awareness and implementation among educators. This theme aligns directly with the Social Ecological Model (SEM), which investigates behaviour

change through multiple interconnected levels. At the individual level, educators' different levels of awareness and utilisation of tools for instance rainwater harvesting tanks demonstrated the impact of personal knowledge and behaviours on water conservation practices within the school environment. The interpersonal level shows how educators' interactions, discussions, and cooperative efforts influence the adoption and implementation of water conservation tools within the school environment. This could involve peer-to-peer education among educators or the influence of colleagues in adopting and making use of these tools. Going to the community level, the findings show inconsistencies across schools, implying variations in community norms, resources, or support systems that influence the adoption of water conservation tools (EL-Nwsany *et al.*, 2019). Societal aspects, for instance policy frameworks or wider cultural attitudes toward water conservation, might also impact how these tools are perceived and implemented. Thus, the SEM lens indicates that effective water conservation programmes should consider and address influences across different levels, from individual understanding and behaviours to community and societal norms, to guarantee comprehensive adoption and utilisation of water conservation tools within schools (Dahlberg and Krug, 2002). Some studies (Miller *et al.*, 2012; Fougères *et al.*, 2020) supports the idea that successful behaviour change interventions must take into account the interconnectedness and influence of individual, interpersonal, community, and societal factors to facilitate sustained and impactful changes in water conservation practices within the school environment.

Theme 8 identifies water-wise practices among learners within the school environment, demonstrating a continuum of behaviours adopted to conserve water. Studies by Akerlof and Kennedy, (2013) and Scarneo *et al.* (2019), specifically within the framework of the Social Ecological Model (SEM), support the multi-level influences on behaviour change. At the individual level, learners showed different water-wise actions for example using lunch boxes or bottles for drinking water and reporting water leakages, demonstrating their commitment to conservation. This resonates with the individual level of the SEM, emphasising individual knowledge, attitudes, and behaviours. However, discrepancies across individuals or groups imply the impact of interpersonal and environmental factors. Interpersonal influences, like peer-to-peer education initiatives among learners, show the role of social interactions in fostering water conservation behaviours.

Moreover, environmental influences, for instance the availability of resources like water storage tanks and educational initiatives, show the significance of the school environment in influencing water conservation practices. The SEM underscores that sustaining behaviour change requires a holistic approach that addresses individual knowledge, social interactions, and environmental factors, highlighting the need for comprehensive interventions that include these multi-level influences promote consistent water-wise behaviours among learners.

Theme 9 focuses on the reporting of leaking taps by learners within the school premises, indicating different levels of awareness and actions regarding leaks. This theme aligns with the Social Ecological Model (SEM), specifically highlighting the interpersonal and community levels. On a personal level, when learners actively report leaks, it indicates their involvement in addressing water-related issues within their immediate environment. This involvement includes interactions with educators, maintenance personnel, or general staff as they identify and deal with such issues. This finding aligns with literature suggesting that interpersonal relationships and communication channels within a community significantly influence behaviour change (Kauppi, 2015; Szymkowiak *et al.*, 2021). Furthermore, at the community level, the variations observed among educators regarding learners' participation in reporting leaks draw attention to the need for a more unified understanding and approach toward promoting and strengthening such behaviours. The SEM stresses that community norms, values, and shared beliefs can influence individual behaviours, emphasising the significance of promoting a culture of collective responsibility and reporting. Krishna *et al.* (2020) recommend that community-wide interventions and support systems can significantly influence individual behaviour, indicating the need for organised efforts across the different school communities to support and strengthen learners' participation in reporting water-related issues for effective water conservation practices.

The last theme describes the expectations from the Water Wise Programme. These findings align with the Socioecological Model (SEM) by demonstrating the relationship between individual, interpersonal, and community levels of influence. The findings show pre-intervention expectations, incorporating desires for fresh ideas, increased knowledge, and practical skills in water conservation. Post-intervention, whilst there was a moderate alignment between expectations and

perceived outcomes, the Water Wise Programme managed to fulfil some of the estimated expectations. This aligns with SEM's individual level, highlighting how educational initiatives can impact individual knowledge and skills. However, it appears these findings also indicate areas for improvement in meeting different expectations fully, reflecting the interpersonal and community levels of the SEM. These results underscore the significance of considering wider community contexts and various perspectives when planning, designing, and implementing water conservation interventions, making sure that they address different expectations across different levels within societies to promote comprehensive and sustainable changes in water conservation behaviours. Studies within the SEM framework underscore that effective interventions should not only focus on individual knowledge but also consider interpersonal relationships, community dynamics, and broader societal influences to ensure holistic and sustainable changes in behaviour towards water conservation (Chaudhary, *et al.*, 2017; Liu *et al.*, 2020; Thakur *et al.*, 2022).

The observations regarding water usage practices within the three selected schools show a combination of behaviour and infrastructure challenges influencing water conservation initiatives. The use of water without reusability, for instance in handwashing practices, taps left running aligns with existing literature highlighting the need for effective water management in school environments (Nkuna, 2019; Curiel *et al.*, 2020). Inefficiencies like leaking urinals and cisterns resonate with studies highlighting the importance of addressing infrastructure issues to conserve water effectively (Knapik, 2020; Li *et al.*, 2022). Furthermore, the theme on water conservation efforts and infrastructure indicates missed opportunities for using water resources efficiently, signifying the importance of functional infrastructure for effective water conservation practices (Mbokazi, 2021). The impact of littering and its effect on the environment, including blockages in waterways, confirms the need for robust waste management approaches within school environment (Matsekoleng, 2021). The lack of a comprehensive environmental policy and limited exposure to different educational programmes aligns with studies which emphasised more structured and multifaceted environmental education strategies (Du *et al.*, 2018). Finally, the lack of active participation in organised environmental programmes and the absence of specific clubs or initiatives devoted to water conservation reflects the need for improved community participation and engagement within schools to drive

sustainable environmental changes (Zhang *et al.*, 2020). Integrating these observations with the other study findings shows the gaps and opportunities for more comprehensive approaches and interventions to promote water conservation and environmental sustainability within school environment.

This study underscores the multifaceted nature of water conservation challenges within the school environment, as revealed through the thematic analysis and detailed observations. The identified themes include educators' knowledge and practices, infrastructure repairs, environmental impact and littering, educational resources and programmes, and school engagement in environmental activities. Integrating these themes with the discussion of observations reveals a complex interaction of factors influencing water usage, conservation initiatives, environmental impact, educational exposure, and community participation within the school settings. The findings highlight the fundamental need for holistic methods that integrate efficient water management practices, repairs of infrastructure, robust educational projects, and active participation at various levels. Integrating insights from existing literature strengthens the importance of implementing comprehensive strategies that not only focus on behavioural patterns but also include policy development, educational improvements, infrastructure development, and promotion a culture of sustainability within the selected schools. By integrating these insights, this study provided a foundational understanding that underscores the need for integrated and multidimensional interventions to foster sustained and effective water conservation practices within schools.

5.2 Conclusion

The chapter has provided a comprehensive exploration and synthesis of the study's findings, aiming to unravel the complexities of water conservation practices in three primary schools situated in high water demand areas within Gauteng. The groundwork laid in chapter 4, which encompassed an in-depth analysis of educators' and learners 'knowledge, perceptions, and the practical implementation of water conservation programme', provided the premise for the discussions presented in this chapter. The chapter revealed a nuanced understanding of the complexities, challenges, and opportunities rooted in water conservation practices within the three schools that were selected for this study. These findings not only contribute to the existing body of knowledge but also

highlight the significance of promoting sustainable practices and informed decision-making in areas related to water conservation. The implications of this research which will be explained in the following chapter extend beyond the school environment; resonating with broader discussions on environmental sustainability and the imperative for thoughtful water management practices in areas characterised high water demand.

CHAPTER 6: RECOMMENDATIONS AND CONCLUSIONS

6 Introduction

This final chapter serves as the conclusion of the study to determine whether Rand Water's Water Wise Education Team's water conservation interventions programmes have achieved the desired outcomes of improving water conservation practices in learners in schools located in high water demand areas within Rand Water's area of supply. Building upon the detailed analysis presented in previous chapters, this chapter focuses on drawing meaningful recommendations and synthesising key conclusions from the study. As the critical importance of water conservation practices in educational environment becomes increasingly evident, this chapter provides practical insights for stakeholders, policymakers, and educators. Through examining the implications of the study findings, proposing actionable recommendations, and summarising overarching conclusions, this chapter contributes to the improvement of water conservation initiatives in primary schools and, by extension, promoting sustainable practices within broader community contexts.

6.1 Conclusion

This study thoroughly addressed the research questions. What are the positive or negative changes in water conservation practices in school learners because of Rand Water's Water Wise Education intervention programmes? Does the Water Wise intervention instil water conservation knowledge on Primary school learners located within a high-water demand area? Does the Water Wise intervention impart water conservation skill to Primary school learners located within a high-water demand area? What sound water conservation practices have the students adopted post the WWET intervention? Do the educators observe a change in water conservation practices at the school post the WWET intervention? To what extent is the information taught by the WWET relevant to the learners in teaching best practices for water conservation? Is there a change in the school's Water bill post the intervention?

By providing evidence on the effectiveness of the Water Wise intervention in instilling water conservation knowledge, practices and skills among primary school learners and educators in high-water demand areas in Gauteng, Province

South Africa. Pre-intervention, both educators and learners exhibited different levels of understanding regarding Rand Water, the implementing organisation of the Water Wise Programme. Based on the findings it can be concluded that the intervention brought about a considerable impact, in terms of refining perceptions and deepening understanding particularly among learners, indicating an improved alignment with Rand Water's objectives and methodologies. The exposure to the Water Wise Programme had mixed effects particularly on the learners' knowledge, skills, values, and practices. Even though there was evidence of knowledge acquisition, especially regarding the significance of saving and purifying water, the translation of this knowledge into everyday behavioural changes was not consistent. The study revealed a nuanced understanding of the complexities and challenges related to water conservation practices within the three schools. Household exposure to the Water Wise Programme also showed mixed outcomes, with learners acquiring knowledge but struggling to implement behavioural changes at home. The study highlighted the need for follow-up interventions to close the gap between knowledge acquisition and practical application in household practices.

Understanding water meters and payment rationale seemed to be a challenging aspect for the learners, with limited pre-intervention knowledge and slight improvement post-intervention. This implied that the Water Wise Programme may not have been as effective in clarifying concepts related to water meters and payment rationale among learners. The management of water resources within the three schools showed a change from decentralised, ad hoc methods to more organised and structured strategies post-intervention. The Water Wise Programme may have contributed to this transformation, promoting a more comprehensive water conservation framework within the three schools.

Learners' behaviour in water conservation highlighted prevalent issues such as littering and water wastage. While there was some awareness of these issues, the study suggested a need for initiatives to address these behaviours and promote a culture of water conservation among learners. Tools for water conservation at schools, for instance rainwater harvesting tanks, showed different levels of implementation, and understanding among educators and learners. Some schools demonstrated proactive approaches, while others showed a lack of awareness, highlighting potential differences in implementation across the

three schools.

The identification of water-wise practices among learners showed a variety of actions, from personal practices to peer-to-peer education initiatives. The findings displayed different water-wise behaviours across the three schools. The reporting of leaking taps by learners implied different levels of awareness and action. Even though some educators observed a proactive approach among learners in reporting issues, others showed a lack of awareness, suggesting a possible gap in uniformity regarding learners' involvement in reporting water-related problems across the three schools. Expectations from the Water Wise Education were different before the intervention, ranging from a desire for fresh ideas to conserve water to the expectation of gaining more knowledge and skills. Post-intervention, there was a positive alignment between expectations and outcomes, with educators expressing satisfaction with the knowledge and skills they had acquired through the Water Wise Programme.

6.2 Recommendations for the Water Wise Programme

There is a need to develop comprehensive educational programmes that include multifaceted approaches to water conservation. These programmes should focus not only on imparting knowledge but also on practical applications such as closing the tap or changing a tap washer, experiential learning, and behavioural change strategies but in collaboration with local water authorities, environmental organisations, and educational institutions in planning designing, engaging and interactive initiatives is a need.

Water conservation interventions such as Water Wise should not be boxed into the CAPS curriculum as there are other curriculums that are being excluded such as the Independent Examination Board (IEB), thus the need for generic knowledge packs with practical generic water information which must be considered by water institutions that seek to transform participants into a water conservative society, these knowledge packs can be adaptable based on the participants needs and their environment to ensure that water conservation interventions such as Rand Water's water wise move from information to transformation. Water conservation interventions, especially those conducted by water institutions should occupy their own niche as they tend to be diluted into other Environmental Education interventions, this in turn takes away habitual

water conservation practices as long as environmental days are observed or a tree is planted on Arbor day for instance.

Establish a collaborative environment involving learners, educators, parents, local communities, and stakeholders.

Create environmental clubs or committees committed to water conservation, however, these should be conducted with the water institutions and specific participants from inception to implementation and evaluation as what works for school A may not work for school B.

Encourage participation in coordinated water education programmes, workshops, and community-led initiatives to instil a sense of responsibility and active participation.

The quality of the water conservation interventions should be prioritised over the quantity of schools the water wise intervention reaches. For enhanced impact, there is a need for these interventions to be continuous programmes, with school revisits and not just once off interventions that address the number of schools the programmes were conducted at.

Ensure capacity-building programmes for educators, empowering them with the knowledge, tools, and approaches needed to effectively integrate water conservation practices into the curriculum and daily school activities. The programme must move from just supplying knowledge but also supply the relevant tools that are needed to aid in water conservation practices, it's not enough to teach them how to change a tap washer but also supply the schools with new washers for their taps.

Promote ongoing research and monitoring to assess the impact of water conservation initiatives and to identify rising challenges. Regular evaluation and data collection will inform relevant and adaptive approaches whilst allowing for continuous improvement in water conservation efforts. Establish collaboration with governmental departments, NGOs, local businesses, and community leaders to leverage resources, share best practices, and establish a supportive environment for sustained water conservation initiatives.

Sustainable behaviour change demands a multifaceted approach involving experiential learning, continuous support, context, relevancy, removing contextual

barriers, and promoting a conducive social environment. Integrating these perspectives into future Water Wise Programmes might assist close the gap between knowledge acquisition and consistent behavioural changes among learners and educators.

6.3 Recommendations for the schools

Prioritise infrastructure maintenance and improvement. Conduct regular checks, maintenance, and upgrades that are critical to address leaking taps, dysfunctional water meters, and broken irrigation systems in educational institutions such as schools. Furthermore, integrate sustainable water infrastructure, for instance rainwater harvesting systems, to boost water usage efficiency.

There is a need to mobilise resources for proper waste management, including the allocation of sufficient dustbins and recycling facilities. Furthermore, ensure the availability of educational resources beyond Water Wise programmes, including experiential learning to differentiate environmental education initiatives.

6.4 Recommendations for policy makers

There is a need to advocate for the development and implementation of clear environmental policies within schools. A dedicated environmental policy premised on water conservation practices, waste management, and sustainability initiatives is important. These policies should align with national or regional environmental frameworks.

For successful implementation of an intervention, there is a need to consider a holistic approach that focusses on educational gaps while bearing in mind the wider systemic and contextual aspects within the SEM to promote a more comprehensive understanding of water conservation practices among educators. Integration of educational initiatives with community engagement, policy developments, and infrastructural improvements could be indispensable in realising more effective and sustained changes in educators' understanding of water-related systems and payments.

There is also a necessity for policy makers to identify Water Education as a separate intervention from Environmental Education (E.E) as water is a cross cutting resource which all people from all walks of life should know how to use

sustainably, even if they are in the economics or commercial space, this includes learners who are not doing Sciences like Geography and Life Sciences which are generally catered for by Environmental Education. Currently, Environmental Education programmes do not appear to sufficiently cater to commercial subject learners, leaving a gap for Water Education for those learners. Water Education should be more inclusive as water is used by all and therefore all should play a role in conserving it.

6.5 Recommendations for future research

There is a need to do follow-up studies to assess the long-term impact of the Water Wise Education intervention on school learners and educators. This can assist by providing insights into the sustainability of behavioural changes and the long-term relevance of water conservation interventions.

There is a need to further explore the challenges and factors associated with the implementation of water conservation practices at the household level. Understanding the challenges faced by learners in translating knowledge into actions at school and even at home could help in developing targeted interventions.

In conclusion, the study effectively addressed the research questions by providing a comprehensive understanding of the impact of the Water Wise Programme on water conservation practices across the three primary schools. The findings contribute valuable perspectives for stakeholders, policymakers, and educators, providing a foundation for informed decision-making and the fostering of sustainable water conservation practices within the educational environment and beyond.

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LIST OF ANNEXURES

ANNEXTURE A: SIX MEANINGS OF BEING WATER WISE



The water wise hand is meant to teach people on how to be Water Wise (Water Conservation) by using their five fingers and the palm of their hands. For one to practice water conservation, they must have the **knowledge** on what, how and why conserve water, **skill** on how to conserve water and lasty they must **value** water. These practices are immediate outcomes that are expected from the learners immediately after the Water Wise Education Team's water conservation intervention at the school.

Respect Water, Respect Life: This part covers how everything on earth needs water to survive from the tree, the cow and even virtual water. These are meant to instill water conservation knowledge and values which are meant to translate to water conservation practices.

Don't waste water: This part highlights activities that we do to waste water such as not using a cup when brushing your teeth and tips on what to do not to waste water. These are meant to instill water conservation knowledge and skill (Tips) which are meant to translate to water conservation practices.

Don't pollute water: This part highlights on how pollution affects water quality and quantity. The participants are also shown that even if a paper is thrown on the school grounds it can be washed or blown away to the nearest water body

thus polluting water and they are also advised to use a bin. These are meant to instill water conservation knowledge, skills and values which are meant to translate to water conservation practices.

Pay for water services: This part explains where water comes from, what services are conducted for water to move from the source to the tap and these services need to be paid for. These are meant to instill water conservation knowledge and values which are meant to translate to water conservation practices.

Take environmental action: This is the part where action is needed, all the knowledge learnt in the other parts is put into action/practice. Fix a leaking tap, use a cup when brushing teeth, use a bin and so forth. Do something about it! These are meant to instill water conservation knowledge and skills which are meant to translate to water conservation practices.

Conserving water, conserving the environment: Now that they have all the knowledge and skill on water conservation, they now have a choice on whether they apply their knowledge and skill at the school or not. It is believed that if they value water then they will practice water conservation. These are meant to instill water conservation values which are meant to translate to water conservation practices.

ANNEXURE B: OBSERVATION SHEET (Completed by researcher).

Observation	Comment
1. Drinking of water	Using hands, cups or no cups/or any other container e.g. cold drink bottles?
2. Washing hands	Under a running tap/in a bowl, water reused?
3.Toilets	Leaking, 2 liter bottle in cistern, Water efficient devices or other?
4. Dripping taps	Yes/No and how many-Where?
5. Does the school have a water meter?	Yes/No
What is the meter reading:	
6. Does the school receive a water bill?	Yes /No

7. Any runoff water?	Captured or run to the garden? Is it harvested?
8. Does the school have a food garden?	Yes/No, When do they water it?
9. How do they irrigate gardens?	Hose pipe, drip irrigation, reused water or other methods
10. Do the learners litter?	Yes/No
11. Any dustbins?	Yes/No and how many?
12. Any recycling (including Water Re-use/Purposing)?	Yes/No and what is being recycled?
13. Any Rand Water's Water Wise poster/resources	Yes/No and which grade? Where are they placed/are displayed on the walls or accumulating dust somewhere.

14. Any other EE initiatives from other stakeholders such as GDARD, SANParks, SANBI etc. at the school?	Yes/No and what kind?
15. Environmental Club towards Environmental/Water Conservation Education in the school e.g., greening projects, recycling etc.?	Yes/No and what kind/Relation to water?
16. Does the school have an Environmental policy on water?	Yes/No, if yes is the school implementing what is on the policy?

ANNEXURE C: PRE & POST INTERVENTION QUESTIONNAIRE.
(N.B: The pre and post questionnaire for the learners will be the same)

Estimated time: 15 minutes

1. Have you been exposed to the Water Wise Program?

Yes

☐

No

☐

Explain what was done during the program?

2. Do you know what Rand Water is?

Yes

☐

No

☐

Please explain what you think Rand Water does.

3. Are you Water Wise?

Yes

☐

No

☐

What does it mean to be Water Wise?

4. What do you remember the most about the Water Wise program that came to your school?

5. What is litter?

5.1 Do the learners at your school litter?

Yes

☐

No

☐

Please explain why?

6. What do you do if you see a leaking tap? (Tick one box)

Leave it

☐

Try to close it

☐

Couldn't be
bothered

☐

Report it to an
adult

☐

Please explain why?

7. What do you do if you see a tap, left opened? (Tick one box)

Leave it	☐
----------	--------------------------

Close it	☐
----------	--------------------------

I didn't open it	☐
------------------	--------------------------

Report it to an adult	☐
-----------------------	--------------------------

Please explain why?

8. Are you polluting water if you throw litter on the school ground or classroom floor?

Yes	☐
-----	--------------------------

No	☐
----	--------------------------

Please explain your answer.

9. Do you save water when brushing your teeth at home?

Yes	☐
-----	--------------------------

No	☐
----	--------------------------

Please explain how you save water when brushing your teeth?

10. How do you drink water from the school tap?

Please explain what you do at the tap to drink water?

11. Name and explain three (3) things you can do at school to show that you are Water Wise?

12. Do you think reusing water is a good idea?

Yes	☐
-----	--------------------------

No	☐
----	--------------------------

Explain your answer (Why?)

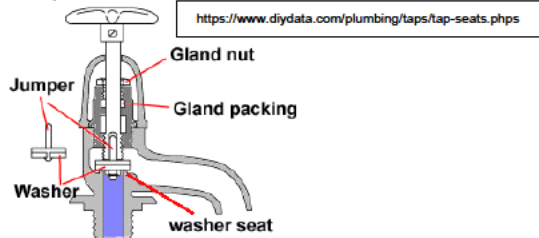
13. Why should you or your parents pay for water?

Please explain your answer.

14. What changes can/should be done your school for it to be a water wise school?

Explain your answer (What and why?)

15. If the Tap is leaking, which part of the tap could be the problem, what can be done to fix the problem?



Please explain your answer.

16. Can you live without water?

Yes

☐

No

☐

Explain your answer (Why?)

ANNEXURE D: Online of Water Wise programmes that learners will be engaged in.

1. Water Wise Roadshow with Manzi “The Tap Duck” character (Duration: 30 minutes).

This programme can be facilitated either at the school or at any of the Water Wise centres.

- An interactive Water Wise presentation with “Manzi” the Water Wise Tap Duck who goes around teaching learners on how to be water wise. The programme also includes a Water Wise song and dance which includes the six meanings to being Water Wise.

2. Water Purification Experiment: (Duration: 1 hour)

This programme can be facilitated either at the school or at any of the Water Wise centres.

- The learners will learn how water travels from the various catchments to Rand Water’s purification stations and how it is purified. In this programme, the learners will do a hands-on water purification experiment which mimics the purification process.
- If this programme is facilitated at the school instead of a tour of the station, the learners will also play a water purification game.

3. FIXING A LEAKING TAP: (Duration: 20 minutes)

This programme will be facilitated either at the school with a demonstration where learners will:

- learn how to change a washer.
- learn how much water a dripping tap can waste in a day and how that can affect the community and Water Demand Management.

4. OUTLINE AT THE SCHOOL:

- Pre-Observation and Consent forms.
- Pre-Questionnaire. **(Day 1 and 15 minutes).**
- Intervention (Roadshow All learners, Purification Grade 7, Fix a leaking tap Grade 7). **(Day 2).**
- Post-Observation and Post Questionnaire. **(Day 3 and 15 minutes).**
- **Total number of hours: 1.50 hours**

ANNEXURE E: PRE & POST INTERVENTION FOR TEACHERS (Duration:15 minutes)

1. Do you know what Rand Water is?

Yes

No

Please explain what you think Rand Water does.

2. Do you know what Water Wise is?

Yes

No

Please explain what you think Water Wise does.

3. Have the learners in your school been exposed to the Water Wise program? What knowledge, skill and values did they demonstrate towards water conservation practices after the program?

Yes

☐

No

☐

Knowledge:

Skills:

Values:

Practices:

4. Have you or anyone in your household been exposed to the Water Wise program? What knowledge, skill and values did they or you demonstrate towards water conservation practices after the program?

Yes

☐

No

☐

Knowledge:

Skills:

Values:

Practices

5. Does your school have a water meter, and do you know where it is located?

Yes

☐

No

☐

Please explain your answer.

6. Does your household have a water meter, and do you know how to read the water meter?

Yes

☐

No

☐

Please explain your answer.

7. Why should you pay for water?

Please explain your answer.

8. Does your school have leaking taps/ toilets, what actions have been taken by the school to aid in rectifying the water loss?

Yes

☐

No

☐

Please explain your answer.

9. Do the learners at your school litter?

Yes

☐

No

☐

Please explain your answer.

9. Do the learners at your school waste water?

Yes

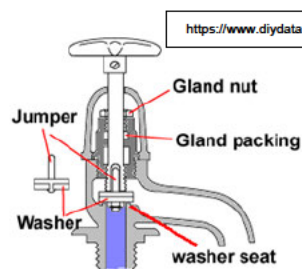
☐

No

☐

Please explain your answer.

10. If you see a leaking tap at the school, it could be?



A worn-out washer

☐

The worn-out rubber inside

☐

Too much use

☐

A broken tap

☐

11. Does the school have tools that aid in Water Conservation practices, such as rainwater harvesting tanks?

Yes

☐

No

☐

Please explain your answer.

12. Name and explain three (3) learner practices at your school that make your school a water wise school.?

Please explain your answer.

13. Do the learners in your school report leaking taps?

Yes

☐

No

☐

Please explain your answer.

14. Did you have any expectations when you heard the Water Wise Education Team was coming to your school?

If Yes, what were your expectations?

Were your expectations met? Please explain your answer.

ANNEXURE F: ETHICS CLEARENCE FROM IIE MSA.



Our Ref: M.480623
Enquiries: research@iie.ac.za

23 June 2023



Outcome of Ethics Clearance Application for Master of Philosophy in Integrated Water Management



Student Name: Sizwe Mndawe
Student number: ST10086162
Brand and campus: IIEMSA



Dear Sizwe

Thank you for submitting the ethics clearance application for the study:
A comparative study of the water conservation practices in three primary schools located in high water demand areas in Gauteng.



We are pleased to inform you that the IIE's Higher Degrees Committee considered and granted ethics clearance. This means that you may proceed with data collection. If you are collecting data from a specific organisation, ensure that you have a gatekeeper's letter that confirms their approval of the data collection being done.

You are reminded that any changes made to the research methodology or title of the research study must be signed off by the IIE's Higher Degrees Committee. Kindly ensure that all ethical considerations are duly applied whilst collecting, analysing and interpreting the data for the completion of your research.

If you have any questions, please feel free to contact your programme team or supervisor directly.

All the best with your research.



Dr WH Engelbrecht
Chair: Higher Degrees Committee

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RAND WATER

ANNEXURE G: CONSENT FORM FOR ADULT PARTICIPATION IN A RESEARCH STUDY CONDUCTED BY SIZWE MNDawe (IIE MSA).

RESEARCH TITLE:

A comparative study of the water conservation practices in three primary schools located in high water demand areas in Gauteng.

1. Research Description

You are invited to participate in a research study conducted by Sizwe Mndawe (IIE MSA). The purpose of this research is to evaluate whether Rand Water's Water Wise Education intervention programs conducted in schools encourage a positive change in water conservation practices in learners.

Your participation will involve completion of the study questionnaires and participation in the Water Wise Education Team programs.

Outline at the School:

- Pre-Observation and Consent forms.
- Pre-Questionnaire. **(Day 1 and 15 minutes).**
- Intervention (Roadshow All learners, Purification Grade 7, Fix a leaking tap Grade 7). **(Day 2).**
- Post-Observation and Post Questionnaire. **(Day 3 and 15 minutes).**

2. Risks and Discomforts

There are no known risks associated with this research for both the researcher and the participants.

3. Potential Benefits

There will be no benefits or remuneration for your participation in this research. This research may help Rand Water to understand whether the Water Wise Education Team's programs have a positive outcome in water demand management demonstrated through water conservation practices by the learners post intervention.

4. Protection of Confidentiality

Your identity will not be revealed in any publication resulting from this study.

5. Voluntary Participation

You will be allowed to withdraw your participation at any given stage of the research should you choose not to participate further. Please note that you will not be penalised in any way as your participation in this study is voluntary.

6. Contact Information

If you have any questions or concerns about this study or if any problems arise, please contact **Mr. Sizwe Mndawe** on [REDACTED] or email [REDACTED]

Consent:

I have read this consent form and have been given the opportunity to ask questions. I give my consent to participate in this study.

Participant's Signature: _____

Date: _____

Please keep a copy of this consent form for your records.



ANNEXURE H: CONSENT FORM FOR LEARNER PARTICIPATION IN A RESEARCH STUDY CONDUCTED BY SIZWE MNDawe (IIE MSA).

RESEARCH TITLE:

A comparative study of the water conservation practices in three primary schools located in high water demand areas in Gauteng.

1. Research Description

Your child has been invited to participate in a research study conducted by Sizwe Mndawe (IIE MSA). The purpose of this research is to evaluate whether Rand Water's Water Wise Education intervention programs conducted in schools encourage a positive change in water conservation practices in learners.

Your participation will involve completion of the study questionnaires, participation in the Water Wise Education Team programs.

Outline at the School:

- Pre-Observation and Consent forms.
- Pre-Questionnaire. **(Day 1 and 15 minutes).**
- Intervention (Roadshow All learners, Purification Grade 7, Fix a leaking tap Grade 7). **(Day 2).**
- Post-Observation and Post Questionnaire. **(Day 3 and 15 minutes).**

2. Risks and Discomforts

There are no known risks associated with this research for both the researcher and the participants.

3. Potential Benefits

There will be no benefits or remuneration for your child that would result from his/her participation in this research. This research may help Rand Water to understand whether the Water Wise Education Team's programs have a positive outcome in water demand management demonstrated through water conservation practices by the learners post intervention.

4. Protection of Confidentiality

Rand Water will do everything it can to protect your child's privacy. Your child's identity will not be revealed in any publication resulting from this study.

5. Voluntary Participation

You will be allowed to withdraw your child's participation at any given stage of the research should you choose not to allow him/her participate further. Please note that your child will not be penalised in any way as your child's participation in this study is voluntary.

6. Contact Information

If you have any questions or concerns about this study or if any problems arise, please contact **Mr. Sizwe Mndawe** on [REDACTED] or email [REDACTED]

Consent

I have read this consent form and have been given the opportunity to ask questions. I give my consent for my child to participate in this study.

Name of Learner: _____

Parent's name: _____

Parent's Signature: _____

Date: _____

Please keep a copy of this consent form for your records.



ANNEXURE: I: CONSENT FORM FOR SCHOOL PARTICIPATION IN A RESEARCH STUDY CONDUCTED BY SIZWE MNDawe (IIE MSA).

RESEARCH TITLE:

A comparative study of the water conservation practices in three primary schools located in high water demand areas in Gauteng.

1. Research Description

Your school is located in an area identified as a high-water demand area; your school is therefore invited to participate in a research study conducted by Sizwe Mndawe from IIE MSA. The purpose of this research is to evaluate whether Rand Water's Water Wise Education intervention programs conducted in schools encourage a positive change in water conservation practices in learners.

Your school's participation will involve a completion of the study questionnaires, participation in one of the Water Education Team programs conducted with All learners, Grade 7 learners and two teachers. Your participation will involve completion of the study questionnaires, participation in the Water Wise Education Team programs.

Outline at the School:

- Pre-Observation and Consent forms.
- Pre-Questionnaire. **(Day 1 and 15 minutes).**
- Intervention (Roadshow All learners for 30 minutes, Purification Grade 7 for 1 hour, Fix a leaking tap Grade 7 for 20 minutes). **(Day 2).**
- Post-Observation and Post Questionnaire. **(Day 3 and 15 minutes).**

2. Risks and Discomforts

There are no known risks associated with this research for both the researcher and the participants.

3. Potential Benefits

There will be no benefits or remuneration that would result from your school's participation in this research. This research may help Rand Water to understand whether the Water Wise Education Team's programs have a positive outcome in water demand

management demonstrated through water conservation practices by the learners post intervention.

4. Protection of Confidentiality

Your learners, teachers or school's identity will not be revealed in any publication resulting from this study.

5. Voluntary Participation

Your school will be allowed to withdraw its participation at any given stage of the research should it choose not to participate further. Please note that your school will not be penalised in any way as your school's participation in this study is voluntary.

6. Contact Information

If you have any questions or concerns about this study or if any problems arise, please contact **Mr. Sizwe Mndawe** on [REDACTED] or email [REDACTED]

Consent:

I have read this consent form and have been given the opportunity to ask questions. I give my consent to my school participate in this study.

School Name: _____

Principal's signature: _____

Date: _____

SGB signature: _____

Date: _____

Please keep a copy of this consent form for your records.