THE EFFECT OF A PERSUASIVE INFORMATION CAMPAIGN ON STUDENTS' INTENTION TO SAVE WATER

A dissertation

by

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Declaration

I know that plagiarism is wrong. Plagiarism is to use another researcher's work and pretend that it is mine.

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I have not allowed, and will not allow, anyone, to copy my work and pass it off as his or her work.

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Abstract

The City of Cape Town (CoCT) experienced three years of drought, which led to the implementation of several water demand management (WDM) strategies by the management of the University of Cape Town (UCT) to facilitate efficient water-saving behaviours among water users. The goal of the WDM strategies was to reduce the rate of water consumption by up to 50% of the regular use. This study implemented a Persuasive Information Campaign (PIC) in four UCT student residences selected on the criteria that they had a smart meter.

This study aimed to examine if a PIC disseminated through Short Messaging Service (SMS), email and both SMS and email could increase students' intention to save water. The use of the different channels was to test the effectiveness of each on students' intention to save water. The extended Theory of Planned Behaviour (TPB) was used as a theoretical model to guide the study in achieving its aim. The main constructs of the theory are attitude (a positive or negative evaluation of the benefits of performing a behaviour), social norms (an individual's social perception of performing a behaviour), perceived behavioural control (how easy or difficult performing a behaviour is), and intention to save water (how hard students are willing to try and how much effort they are planning to exert to save water). The additional constructs added to the theory were PIC (a persuasive message advocating for less water consumption by students), knowledge about the need for water-saving (students' perception about water-saving), and exposure to information about water crisis (sources and channels of information about water crisis).

A total of 145 questionnaire responses were collected and analysed using the Partial Least Square Path Modelling (plspm) package in R software. The factor loading results from the data analysis showed that students who received the PIC by both SMS and email channel were the most persuaded to increase their intention to save water. While the students who received the PIC through SMS only was the next persuaded. The students who were least persuaded by the PIC were the ones who received the PIC by email only.

The overall analysis revealed three main predictors of student's intention to save water, and these include students' knowledge about the need for water-saving (strong positive effect), attitude towards water-saving (strong positive effect), and perceived behavioural control

(marginal positive effect). These results suggest that the more positive students' attitudes are towards water-saving, and the more knowledgeable they are about water-saving, the higher their intention to save water will be. Although PIC was not among the predictors of students' intention to save water, it had a strong positive effect on students' attitude towards water-saving. This effect also suggests that PIC is important in achieving attitudinal change among students. This study is the first study conducted using PIC as a new construct added to TPB and in the context of a higher institution of education.

Dedication

I dedicate this thesis to my late dad, Mr Jezhi Ishaku Azaki. I know you would have been proud to see this dream come true.

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Chapter One

1. Introduction

Freshwater has its sources from wetlands, lakes, ponds, rivers, streams, springs, and wells (WWF-SA, 2016). It is necessary for survival and basic human dignity. It is also critical for production and sustainable economic growth (Bates et al., 2008; United Nations Development Programme (UNDP), 2006). However, there is not enough freshwater to meet all human and economic needs, which puts stress on the limited freshwater resources (Dvarioniene & Stasiskiene, 2007; Giurco et al., 2011). Rapid economic growth, rise in population, and climate change are among key activities that put the world's freshwater resources under stress (Jansen & Schulz, 2006; Lewis & Hendrix, 2012). Other factors are food consumption, technology, lifestyle and economic policies (Bates et al., 2008).

The United Nations World Water Assessment Programme predicts that by 2050, 57% of the global population will be found in regions of the world where water scarcity is suffered at least one month annually (WWAP (United Nations World Water Assessment Programme)/UN-Water, 2018). To mitigate this, measures for preserving freshwater resources need to be adopted, especially in water-stressed regions such as South Africa, and in Cape Town, one of South Africa's major cities that experienced a drought from 2015 to 2017 (Fisher-Jeffes, Carden, Armitage, & Winter, 2017; Muller, 2017; Wolski, 2018; World Wildlife Fund, South Africa (WWF-SA) & Boston Consulting Group (BCG), 2017).

The University of Cape Town (UCT) is a major water user under the educational category of the City of Cape Town's (CoCT's) groupings (Fell & Winter, 2018). With an average of 30,000 students and staff in 2017, the University consumed an estimated 40,000 Kilolitres of water per month across all its campuses, each person using approximately 44 litres per day (Fell & Winter, 2018). Although the water consumption was less than 50 litres per person per day, the need to save more water for the long-term benefit was crucial. A Water Task Team (WTT) was constituted by the University to develop, advise on and implement interventions that will enable the University to achieve its water-saving goals for the long-term (Price, 2018b). According to Fell & Winter (2018) (members of the WTT), students' water consumption was observed at some point rose to 160 litres per student per day in 2017. Consuming 160 litres per student per day was considered unsustainable by the University's management, given the water crisis (Price, 2018b). Price (2018b) highlighted the reasons why the University

management set a goal of reducing water consumption by at least 50%. The reasons were: firstly, to avoid "Day Zero" – this referred to a day when the water supply to households will be turned off, and residents will have to queue at designated water points within the city to collect water for daily use (Cole, 2017; Enqvist & Ziervogel, 2019). The second reason was to ensure that the members of the University community become water-efficient users such that; should "Day Zero" come, the University community would have been prepared to use water optimally; and thirdly, to avoid severe financial penalties by the CoCT due to high water consumption.

UCT employed several interventions to conserve water both at students' residence and academic buildings on campus. The interventions used at student residences included the provision of buckets to students to collect greywater for re-use, installing water-efficient washing machines, and changing showerheads (Price, 2018c). Other interventions at both students' residences and academic buildings were replacing faucets and toilets to water-efficient ones (Price, 2018c). The University additionally employed information campaign by the name "*Slow The Flow*", to further drive the goal of using less water within the University community.

1.1 Problem Statement

Given the water crisis experienced by the CoCT, and the decision by UCT to cut water consumption by 50%, this research seeks to uncover the role of a persuasive information campaign (PIC) to increase the cooperation of UCT students to reduce their water consumption, following the high water consumption at students' residences. In order words, this research aims at assessing the effectiveness of a PIC using different channels (Short Messaging Service (SMS), email and both SMS and email) on the intention of students to save water, specifically those living in the residences. In doing so, this research provided useful information on the effectiveness of a PIC as a strategy to achieve water-saving goals in an institution of higher education.

Fielding et al. (2013) and Katz et al. (2018) reported that the use of information campaigns has the potential to encourage water-saving practices. Examples of places where studies focusing on the use of specific information campaign as a medium to encourage reduced water consumption in water-stressed areas are, in Israel (Katz et al., 2016), in Australia

(Renwick & Green, 2000), and Malawi (Mulwafu et al., 2003). However, most of these studies used norm-based, assertive, and suggestive messages and not persuasive messages (details in chapter two). This study filled this gap by investigating the effects of a PIC on students' intention to save water in UCT residences.

1.2 Research Question

The main question that this research seeks to answer is:

To what extent does a Persuasive Information Campaign using SMS and email influence UCT students' intention to save water?

1.3 Aim and Objectives

This study aims to examine whether a PIC through SMS or email can play a role in further encouraging the intention to save water by students in an institution of higher education.
The specific objectives of this research are:

1. To disseminate persuasive messages to students residing at UCT residences, through email only, SMS only and both SMS and email, requesting them to consider reducing their water consumption.
2. To monitor the water consumption rate of students in the residences that received the persuasive messages, by obtaining daily water consumption rates (pre, during and post-intervention) through the smart meters installed in the residences.
3. To determine which channel (SMS, email and both SMS and email) of disseminating a PIC was more effective on the students' intention to save water.
4. To evaluate the overall effectiveness of the PIC carried out on students' intention to save water by using an extended theory of planned behaviour.

1.4 Contribution of the Study to Theory and Practice

1. This study provided insights on the use of a PIC using SMS, email and both SMS and email within a university environment (more specifically within student residences).
2. This study provided insights into how UCT management could leverage the use of a PIC as a strategy in achieving reduced water consumption in students' residences.

3. The outcome of the study enhanced understanding of the effectiveness of a PIC in an institution of higher education.

4. The study contributed to knowledge theoretically by developing a conceptual model – an extended Theory of Planned Behaviour – and using partial least square path modelling.

Chapter Two: Literature Review

2.1 Water Crisis

A water crisis is a situation generally characterised by drought which results to low quality and quantity of freshwater supply to meet the water demand of a population for daily socio-economic activities (Department of Water Affairs (DWA), 2013; Seyranian et al., 2015). Drought is usually a result of the stress that freshwater resources experience due to negative anthropogenic activities and climate change (WWF-SA & BCG, 2017). The main factors that impact these available water resources are increasing human population, urbanisation, and climate change (CoCT, 2018c; Enqvist & Ziervogel, 2019; UN-WWAP, 2016).

2.2 Water Demand Management

Water Demand Management (WDM) is a process of developing and implementing strategies (administratively, financially, socially, economically or technically) to control the quantity or quality of freshwater available for consumption (Brooks, 2006). The government and relevant stakeholders employ WDM strategies in an attempt to influence citizens' water usage and to conserve water both in quality and quantity; some of these strategies are followed more strictly during periods of water crisis (Turton, 1999).

The strategies typically used in WDM are water restrictions (Bauer & Scholz, 2010; Sahin et al., 2017), water allocation (City of Cape Town, 2015; Renwick & Sandra, 1998), replacing water appliances with highly water-efficient appliances (retrofitting) (Brelsford & Abbott, 2017) (Brelsford & Abbott, 2017; Horsburgh et al., 2017), smart meter installations (Cominola et al., 2015; Horsburgh et al., 2017), increased block tariffs (Fan et al., 2013; Katz et al., 2016) and information campaigns (Brelsford & Abbott, 2017; Katz et al., 2018). Others are replacing alien invasive plants with indigenous plant species (Branco et al., 2015; Mostert et al., 2017) as well as reducing the volume of unaccounted water by fixing leakages (Farah & Shahrour, 2017).

2.2.1 The Use of Technology in Water Demand Management

Technology – and specifically Information and Communication Technologies (ICTs) – have been used in the past two decades in the water sector to facilitate WDM (Nel et al., 2014; Nguyen et al., 2018; Tortajada et al., 2019). ICTs such as smart devices (phones, meters, sensors) are essential tools for data collection, support in operational management decisions,

and information dissemination (Cosgrove & Loucks, 2015; GSMA, 2017). The benefits derived from these ICTs have contributed significantly to overcoming some of the challenges faced in WDM (GSMA, 2017). However, the implementation of identified ICT solutions is region-specific because water demand scenarios differ across the globe (Werner & O'Doherty, 2012). The application of ICTs in WDM could be computer-based technology, mobile phone technology, smart technology and web-based technology (Baki et al., 2018; GSMA, 2017; Whittington, 2014).

The Use of Smart Water Meters in Water Demand Management

Smart water meters (SMW) are intelligence providing devices (Farah & Shahrour, 2017; Nguyen et al., 2018). SWMs are fitted with data loggers to record the rate of water consumption at specified time intervals and communicate the readings automatically with a server (Farah & Shahrour, 2017; Makki & Stewart, 2015). The readings logged by the data logger shows the pattern of water usage by a household, organisation, or individuals (Boyle et al., 2013), thereby providing an excellent tool with which to monitor consumption, provide feedback and monitor the effects of water-saving interventions (GSMA, 2017). The analytics provided by SMW as feedback can influence decision making by the head of households or managers of organisations. The use of SWM can potentially help in identifying leakages (GSMA, 2017; Lewis & Hendrix, 2012).

Leakages are detected when there is an abnormal pattern of water consumption for an extended period (Farah & Shahrour, 2018). Farah & Shahrour (2018) observed the water consumption pattern of the Scientific campus of Lille University in North France. The authors classified their observations into working and non-working days, each having lower and upper limit values of consumption. They found out that, on the days when the upper limits for both the working and non-working days were exceeded, there was a 100% chance of leakage.

One of the ways the CoCT utilised smart technologies during the water crisis was in the installation of water management devices (WMDs) (City of Cape Town, 2018). WMDs are advanced smart water meters fitted with automatic valves that are activated to shut off or limit water supply. The WMDs were used to control the water supply in residences within the city by stopping the flow of water once the daily usable volume set by the city was reached.

The WMDs forced residents to use water sparingly (City of Cape Town, 2018; van Zyl et al., 2018).

The Use of Mobile Phones in Water Demand Management

There is a growing number of mobile phone subscribers in sub – Saharan Africa with a projected rise from 44% to 52% between 2017 and 2025 (Global System for Mobile Communications' Association (GSMA), 2018). This increase in the number of mobile phone subscribers in sub–Saharan Africa provides a viable platform for more research into the use of technical innovations that will help with the efficient use of natural resources such as water (Nel et al., 2014; Rediana & Pharmasetiawan, 2017).

There have been cases where solutions implemented using mobile technology have been successful in achieving effectiveness in water demand management across the globe. One example of these mobile technology innovations is the study by Rivett et al. (2012). The study used a cell phone-based information system for the collation of information about water quality from rural municipalities. This innovation bridged the monitoring and reporting gap between the National Blue Drop System and the Water Service Authorities in those municipalities – the National Blue Drop System is a system that collates water quality data and assesses the data provided by Water Service Autihorties for quality control purposes. The cell-based information system further assisted the Water Service Authorities in meeting the standard regulatory requirement for water quality control.

Another example is the study by Jonoski et al. (2012), where SMSs were used to create awareness of water shortages in specific locations of Delfland in the Netherlands and also received feedback from the water users. Their work underscored the importance of a synergised effort between managers and users in decision making within the water domain using SMS. One of the useful characteristics of mobile phones is the fact that they are personally owned (Jonoski et al., 2012), thereby engaging the public at an individual and personal level.

2.2.2 Information Campaigns and their Role in Encouraging Water Conservation

Information campaigns help to disseminate strategic information to alert the general public about water shortages and to motivate water-efficient behaviour (Lewis & Hendrix, 2012;

Renwick & Green, 2000; Syme et al., 2000). Using information campaigns to reach the public during a water crisis achieves the following: bridge knowledge gaps in water-saving tips (Seyranian et al., 2015), create a general awareness about a water crisis (Pérez-Urdiales & García-Valiñas, 2016), promote retrofitting (Martínez-Espiñeira & Nauges, 2004; Millock & Nauges, 2010) and engage the public to voluntarily cut down their water consumption (Katz et al., 2016; Kronrod et al., 2012). The end goal of all these water-related information campaigns is to reduce water consumption.

For water-related information campaigns to be successful, what is said, how it is said, the source sending it, and the medium used in sending it are vital (Dziegielewski, 1991; Ferraro & Price, 2013). Water users will respond to a message only if they perceive the message as clear, specific, concise, applies to them and emanate from a credible source (Dziegielewski, 1991; Ferraro & Price, 2013).

Across the literature, the dissemination of water-related information campaigns was done through postal mail (Ferraro & Price, 2013; Katz et al., 2016; Schultz et al., 2014), postcards (Katz et al., 2016, 2018), emails (Dolnicar & Hurlimann, 2010), water bills (Katz et al., 2016, 2018; Schultz et al., 2014), television (Dolnicar et al., 2011; Dziegielewski, 1991) web-based systems (Schultz et al., 2014), signposts and posters (Witzling et al., 2015), newspapers (Howarth & Butler, 2004) and social media (Booysen et al., 2019). Some of these studies cited above disseminated messages using a single platform (Dolnicar & Hurlimann, 2010) while others used a combination of two or more platforms (Ferraro & Price, 2013; Howarth & Butler, 2004; Katz et al., 2018; Schultz et al., 2014).

The tone of the messages sent during a water-related information campaign could be assertive, suggestive, or persuasive (Katz et al., 2016, 2018). Assertive information campaign uses a coercive tone, for instance, "You must conserve water" while suggestive can be a suggestion such as "it is worthwhile to save water" (Katz et al., 2018). A persuasive information campaign, on the other hand, takes a gentler approach such as "Please consider saving water" (Katz et al., 2018; Landon et al., 2016). Although several studies have examined the use of assertive and suggestive messages as information campaign tools aimed at getting people to reduce water usage, none have studied the use of persuasive messages on water saving (Katz et al., 2018).

In comparing the use of suggestive and assertive messages, Katz et al. (2018) carried out an experimental study where 500 households received the assertive message "You must save water!", Five hundred others received the suggestive message, "It is worthwhile to save water," while another 500 households served as control and received no messages. Katz et al. (2018) monitored the water consumption rates of the households in the three groups and reported a 7.6% reduction in water consumption for the households that received suggestive messages against a 6.1% reduction for households that received assertive messages in comparison to the control group. The study further reported that the decrease in water consumption was sustained over time by the households that received suggestive messages than did the ones who received assertive messages.

A water-related information campaign can also be norm-based. Norm-based messages are messages built on perceived personal or social values, which can either be descriptive or injunctive norms (Schultz et al., 2014). A descriptive norm can be referred to as an individual's opinion about the general acceptance of a particular behaviour within a group. In contrast, injunctive norms refer to an individual's view on how other group members will socially judge an individual if such individual engages in a particular behaviour (Schultz et al., 2014). Personal norms are an individual's set of beliefs which can modulate an individual's behaviour (Ferraro & Price, 2013). Ferraro and Price (2013) defined social norm messages as messages that put an individual's opinion in the light of public opinion. It could either be strong or weak (Bernedo et al., 2014; Ferraro & Price, 2013). Bernedo et al. (2014) describe a strong social norm message to typically contain a social comparison of households' water consumption, for example, "Your water consumption from June to October 2006 is 52,000 litres… You consumed more water than 73% of your neighbours." A weak social norm message does not contain a comparison of water consumption, for example, "Your water consumption from June to October 2006 is 52,000 litres". Bernedo et al. (2014) after conducting a field experiment where they sent norm-based messages (as letters) to households, reported that recipients of weak social norm reduced water use by an average of 3,406.87 litres while the recipients of the strong social norm message reduced water use by an average of 6,586.62 litres. Using behavioural nudges to motivate households to conserve water in the City of Cape Town, (Brick et al., 2017) found that households which received social norm-based messages reduced their water consumption by 208 litres per month. This reduction in water

consumption was attributed to how important households viewed water conservation as a social activity done for the general well-being of the public.

2.3 The CoCT's Use of Water Demand Management in the Recent Water Crisis

The severity of the drought in the Western Cape between 2015 to 2017 necessitated that the CoCT employ stringent measures to reduce water consumption by the public. The CoCT implemented a series of water restriction that culminated in level 6B. Level 6B water restrictions entailed imposing stringent water-saving measures (such as an increased block tariff, water allocation – limited to 50 L per person per day) on residents (see appendix F1 and F2 for the various water restrictions and their price regimes). Defaulters of the water restriction measures were fined (CoCT, 2018b). These measures were adopted in an attempt to avoid "Day Zero". To help curb "Day Zero" further, the CoCT employed water-saving campaigns that cost the city over R1 million - R500,000 was spent on marketing materials and its distribution, while R656,000 was spent on communication strategy consultancy from November 2017 to February 2018 (Palm, 2018).

Additionally, water tariffs were increased significantly; for instance, when Level 6B water restriction declared by the CoCT on February 1 2018, the water tariff for educational institutions was increased to R 57 per Kilolitre from R 24.72 paid under previous restriction tariff (CoCT, 2017, 2018a; Fell & Winter, 2018). This price increase was in effect until a new price tariff was announced by the CoCT in October 2018 for level 5 water restriction (Fell & Winter, 2018) See appendix . The price increase implied that UCT's water bill surged by almost 400% should water consumption at the student residences continue at the observed 160 litres student per day, compared to the initial consumption of 42 litres per person per day.

2.4 UCT Water Crisis Management and Interventions

Following the water crisis that the CoCT experienced and the increase in water tariff imposed by the CoCT, UCT needed to reduce water consumption by 45% to avoid incurring extra water costs (in the form of tariffs and penalties) (Fell & Winter, 2018). As a result of this need, the University implemented measures that would lead to a reduction in the water consumed by the UCT community. Key departments within the University such as the Property and Service Department (P&S), the Communications and Marketing Department (CMD) and the Future

Water (FW) research institute (who managed the UCT Water Desk during this time) coordinated the implemetation of the mesaures. The P&S Department installed water-efficient washing machines in several residences. Other strategies employed were the installation of smart water meters at students' residences and other academic buildings, provision of 7,000 buckets to students in the various residences to capture greywater for flushing toilets, replacing showerheads, toilets and faucets aerators to water-efficient ones (Price, 2018a).

Some of the interventions put in place by UCT, such as the water-efficient washing machines and faucet aerators, are automatic systems that put reduced water consumption outside the control of students. For instance, the efficient washing machine used 45 litres per wash against the 145 litres used by the previous washing machine; this intervention alone saved 100 litres per wash (Moore, 2018). However, there are aspects of the intervention that required the active participation of members of the UCT community to reduce water consumption. Based on this, the University through the CMD and FW undertook awareness campaigns throughout the University to create awareness on the need to use 50 litres of water or less per day per individual. The CMD and FW used print media (flyers, posters, banners and stickers), internet push notifications and news articles as ways of creating adequate awareness about the water crisis, and to gain the cooperation of the UCT community towards achieving the goal of reduced water consumption. The UCT print media campaign employed normative languages as shown in Figure 2.1A ("I have reduced my water consumption by half, have you?") and educated the members of the community as shown in Figure 2.1B (Know your litres). Know your litres is a campaign that presented a breakdown of how one can utilise 50 litres or less per day efficiently. For instance, in Figure 2.1B, out of the 50 litres a person had for a day, one could use 15 litres for a 90 seconds shower, 2 litres for drinking, 3 litres for teeth brushing and face washing, 9 litres for flushing the toilet and so on. The breakdown of water usage provided a sense of responsibility and accountability.

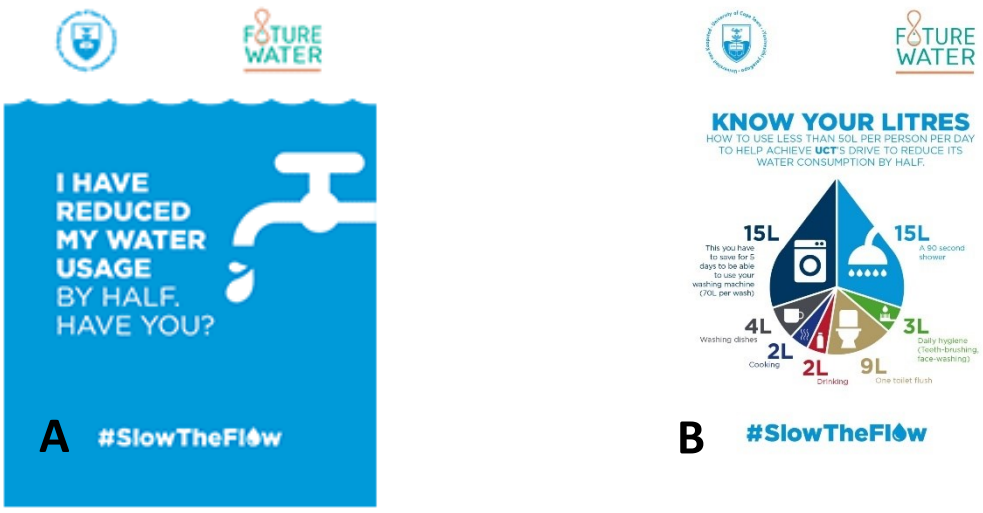

Figure 2.1: Sample of UCT's campaign materials

2.5 The Current Study

Literature has shown that having adequate knowledge about a required action will enhance the performance of such an action (Ferraro & Price, 2013; Schultz et al., 2014). Since the campaigns by UCT about the water crisis and how to save water was already ongoing, this research assumed that the study population was already knowledgeable about the need to save water (this assumption was tested during the data analysis, see chapter four for details).

The aim of the campaign carried out in this research was not to foster awareness/knowledge about water-saving per se but to further encourage students' intention to save water through a persuasive information campaign. The information campaign was done using SMS, email and both SMS and email at selected student residences. The use of these different channels was to assess the performance of each in increasing students' intention to save water. These channels have a unique characteristic of being personal to the user. Therefore, messages received through them may be perceived as directed to a specific individual and may be taken more seriously than those directed to 'nobody' or the general public. This intervention differed from other interventions by UCT, in that, it was focused on selected student residences, whereas other efforts focused on the entire University community.

2.6 Theoretical Model

A researcher can assess the interactions between an information campaign and its resultant effect on the intention to save water through a theoretical model. This section discusses the theoretical model adopted for this study.

A theory is a set of systematically interrelated constructs, propositions, hypotheses intended to explain and predict a phenomenon of interest, with certain conditions to meet (Bacharach, 1989; Bhattacherjee, 2012). A construct is an abstract concept selected to provide some explanation about a phenomenon (Bhattacherjee, 2012). Constructs are either unidimensional, e.g. a person's height which can be directly measured, or multi-dimensional, e.g. a person's intelligence, which has several variables that define it, e.g. speaking ability, writing ability, comprehension (Bhattacherjee, 2012). Constructs in scientific research are mostly multi-dimensional – implying they cannot be measured directly – they are only measured using variables or indicators (Bhattacherjee, 2012; Straub et al., 2004). A variable is a measurable representation of a construct (Bhattacherjee, 2012). A proposition is a statement that declares the relationship existing between constructs and hypotheses are statements that show the relationship among variables – variables can either be dependent or independent (Bhattacherjee, 2012).

Therefore, a theoretical model is a system that brings together the described components above to provide an output that will explain a phenomenon of interest which a researcher is studying (Bhattacherjee, 2012). In this study, the constructs of extended Theory of Planned Behaviour were multidimensional and consisted of the dependent variable – intention to save water – and independent variables – attitude towards saving water, knowledge about the need for water-saving, social norms, perceived behavioural control, exposure to information about the water crisis and persuasive information campaign.

Bhattacherjee (2012) outlines some benefits of using theoretical models in research: they provide explanations of underlying logic that drives the occurrence of natural or social phenomena. Theoretical models also aid sense-making by synthesising findings from other researchers about a phenomenon of interest. It further strengthens cumulative knowledge by covering knowledge gaps between the relevant theoretical model and motivates for more

tests on existing ones. By undergoing more tests, models show how limited or efficient they can be in understanding a phenomenon of interest (Straub et al., 2004).

The majority of the literature seeking to understand factors that lead to reduced water consumption are focused on studying behaviour, attitude, behavioural intentions (the phenomenon of interest for this study) and norms (Dascher et al., 2014; Froehlich et al., 2010; Katz et al., 2016; Senger et al., 2017; Wells et al., 2016; Zhong et al., 2019). The most common theoretical model used in the literature that seeks to explain the effects of information campaigns on behavioural intentions is the Theory of Planned Behaviour (TPB) (Clark & Finley, 2007; Lam, 1999; Trumbo & Keefe, 2001). Some studies also used Theory of Reasoned Action (TRA) (Marandu et al., 2010; Trumbo & Keefe, 2005) and to a lesser extent, the Elaboration Likelihood Model (ELM) (Krajewski et al., 2019; Schultz et al., 2014). TPB and TRA are quite similar as both measure behavioural intentions, but ELM is entirely different. Below is a brief description of ELM and a detailed description of TPB.

Elaborate Likelihood Model (ELM)

Petty & Cacioppo (1986) developed ELM (Figure 2.2). The model comprises two routes through which persuasion occurs: the central and the peripheral routes. The model has seven postulates which are: seeking correctness, variations in elaboration, arguments, cues and elaboration, objective elaboration, elaboration versus cues, biased elaboration and consequences of elaboration (Petty & Cacioppo, 1986). It uses information (argument, persuasive messages) as a means to drive attitudinal change in an individual (Petty & Cacioppo, 1986). Information or argument is contained in a message intended to persuade an individual towards an action being advocated for. For example, "we should raise tuition so that more books can be purchased for the library" presents a strong argument for why tuition should be raised; and "we should raise tuition so that more trees and shrubs can be planted on campus" presents a weak argument for why tuition should be increased (Petty & Cacioppo, 1986 p.133).

ELM regards the careful examination of the advantages and disadvantages of the intended action being advocated by an individual as an elaboration likelihood (Petty et al., 1983). According to Petty & Cacioppo (1986), both the central and peripheral routes lead to attitudinal change in an individual, which is represented by the (+) from the central and

peripheral routes constructs (figure 2.2). Under the central route, an individual engages with the quality of argument elaborately presented in the message before accepting to have an attitudinal change, hence, the (+) sign from the elaborate likelihood to attitudinal change (figure 2.2) (Petty & Cacioppo, 1986). On the other hand, the peripheral route has a (–) sign because an individual does not engage with the quality of the argument in the message, but instead follows cues from either general opinion or the fun of it (figure 2.2) (Petty & Cacioppo, 1986).

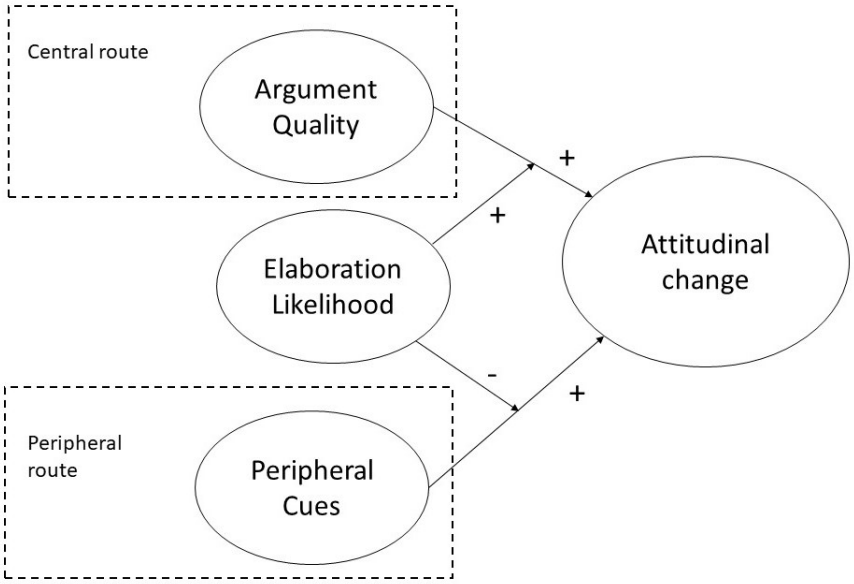

Figure 2.2 Elaborate Likelihood Model (Petty & Cacioppo, 1986)

Theory of Planned Behavioural (TPB) and its Applications to Water Saving

The Theory of Planned Behaviour by Ajzen's (Ajzen, 1991) (Figure 2.3) assumes that a person's intention captures the motivational factors that influence the person's behaviour. The theory emphasises that intentions are indications of how hard people are willing to try and how much effort they are planning to exert, to perform the behaviour (Ajzen, 1991). At its core, the TPB focuses on the prediction of intentions (Ajzen, 2011). Ajzen (1991) states that the individual's intention to perform a given behaviour is driven by three independent constructs. The first construct is an individual's attitude toward the behaviour (A) which comprises an evaluation of the behaviour to be performed by an individual. The second construct is an individual's social norms (SN); this is the extent to which an individual judge**s** the social pressure associated with a behaviour. It is premised by what an individual perceives to be the

expectation from his/her social circles and the drive to comply with a behaviour. The third construct is perceived behavioural control (PBC), this is how an individual perceives the level of difficulty in performing a behaviour, this is premised by self-efficiency to perform a behaviour and how they perceive they can have control over the behaviour (Ajzen, 1991). The higher the intention to perform a behaviour, the higher the performance of the behaviour will be.

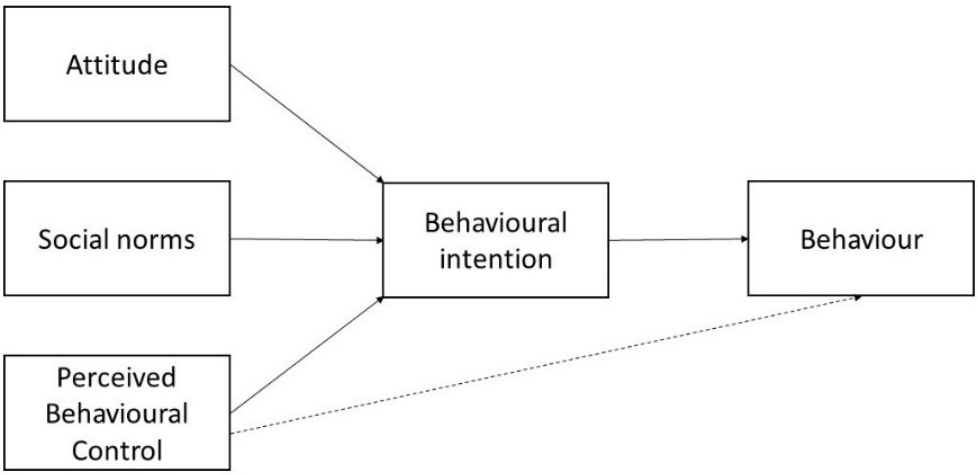

Figure 2.3 Theory of Planned Behaviour (Ajzen, 1991)

Trumbo & Keefe (2001) found in their study that TPB accounted for the intention to conserve water, after using a set of constructs underlying water conservation behaviour in three distinct communities located in the California–Nevada Truckee River Watershed. In a subsequent study, Trumbo & Keefe (2005) collected data to append the previous data from 2001. They analysed the data using path analysis, a method that allows the execution of "simple regressions to latent variables in Structural Equation Modelling (SEM)" (Trumbo & Keefe, 2005 p.577). The discussion on SEM is in chapter 3.

Similarly, Clark & Finley (2007) applied TPB to test the determinants of the intention to conserve water among residents of Blagoevgrad, Bulgaria. Additionally, Clark & Finley (2007), in their study, considered the effects of sociodemographic, environmental attitudes, information possession, and concern over future shortages on water conservation intention of the population tested. They reported that TPB constructs showed positive and significant correlations with water conservation intention of their study population.

A study by Witzling et al. (2015) incorporated information exposure and perceived knowledge into TPB and used a series of hierarchical regression and path models to analyse their data. They reported that exposure to information was positively associated with perceived knowledge, TPB default variables were all positively associated with compliance, and perceived knowledge was positively associated with PBC.

Generally, an individual's attitude and PBC are consistent as the main predictors of behavioural intention and actual behaviour; while on the other hand, an individual's social norms sometimes have little or no effect on behavioural intentions (Armitage & Conner, 2001). Armitage & Conner (2001) further state that, of many studies conducted using TPB, most results show a weak relationship between behavioural intention and actual behaviour, implying a generally weak relationship between the two constructs. The weak relationship could be because studying behaviour can be very challenging, in that, it requires a substantial amount of time to ascertain whether there is a change in behaviour or not (Miller, 2017; Syme et al., 2000). In this study, the behavioural intention was measured and not the actual behaviour.

2.7 Chapter Summary

Whereas chapter one outlined the problem statement, aim, and objectives of the study, chapter two presented a literature review of related studies highlighting how this current study differs or relates to them as well as the gaps it fills. It is a fact that global water shortages are on the increase and the need to be intentional as well as actively involved in saving more water is imperative now more than ever. The chapter ends with a review of the theories used in studies seeking to understand factors that lead to reduced water consumption.

Chapter Three: Research Design and Methodology

A research design is the detailed steps a researcher intends to follow in carrying out an intended research project or study, i.e., steps taken to answer the research question(s) (Bhattacherjee, 2012). These steps range from philosophical assumptions to methods of data collection, data analysis and data interpretation (Creswell, 2014). The sections presented in this chapter highlight the steps used for conducting this study.

This research aims to examine the effect of using a persuasive information campaign using SMS, email or both SMS and email, in an institution of higher education to encourage further students' intention to save water in their residences. As one of the first kind of research to be conducted in a university environment, the research is exploratory in nature.

3.1 Research Philosophy

Research philosophy refers to a system of beliefs and assumptions on how developed knowledge comes about (Saunders et al., 2016). The concept of research philosophy is fundamental for research conducted in Information Systems (IS) (Orlikowski & Baroudi, 1991). Research philosophy impacts a researcher's understanding of the research question, choice of methods to be used in conducting the research, interpretation of findings and presentation of knowledge from the research (Crotty, 1998; Orlikowski & Baroudi, 1991). The two philosophical standpoints that are broadly known for scientific research are ontology and epistemology (Bhattacherjee, 2012).

Ontology, as a philosophical standpoint, is concerned with the nature of reality (Saunders et al., 2009). In other words, it concentrates on the assumptions and claims through which the world is viewed (Bhattacherjee, 2012; Crotty, 1998). It has two main classifications – objectivism and subjectivism (Saunders et al., 2007). These ontological stances depend on the researcher's view of the existence of social entities as objective and independent of humans (such as measurable facts, data-based), or as subjective and dependent on social actions (human actions like emotions or gestures) (Orlikowski & Baroudi, 1991).

The ontological stance adopted for this study was objectivism. (Bhaskar, 2011; Saunders et al., 2016). In applying this stance, I found the existence of reality objectively, by developing a

conceptual model and questionnaire that will suitably fit the dimensions of reality I have interest in (Orlikowski & Baroudi, 1991).

Epistemology refers to the assumptions about the best ways through which the world or a phenomenon can be studied (Bhattacherjee, 2012). It is concerned with two fundamental constituents of research which are: what knowledge is and how knowledge is acquired (Hirschheim, 1985). There are three categories by which the available literature establishes knowledge claims; they are positivist, the constructivist (interpretivist), and the critical realist (Tuli, 2010). Each of these categories has defined approaches to how knowledge is acquired and established (Hirschheim, 1985).

The critical realist assumes that the existence of external reality is dependent on an underlying reality that causes the existence of the external reality in question (Reed, 2005; Saunders et al., 2016). Their assumption about reality is that reality is both external and independent, but cannot be accessed by the researcher through observation and consciousness about such reality (Saunders et al., 2016). Two steps are known to the critical realist in understanding reality, first is the sensuality of real events, second is the mental processing of events that have occurred through a process termed as 'retroduction' (Reed, 2005). The critical realist directs research process towards the causal factors that account for the empirically observable events and behaviours (Danermark et al., 2002).

The interpretivist assumes that the acquisition of knowledge is solely from the meaning attached to a phenomenon of interest by social actors (humans) (Saunders et al., 2016). Interpretivism takes an empathetic approach (using language, conscience, shared meaning) to understand the phenomenon of interest (Myers, 1997; Saunders et al., 2016). The knowledge derived from this approach comes through individual interpretation and experience of social actors with the phenomenon of interest, thus, making knowledge subjective (Walsham, 1993). The interpretivist aims to gain deeper insight into the phenomenon of interest and end up building a theory which is in contrast to the positivist (discussed below), who seeks generalisation of theory into other contexts (Bhattacherjee, 2012; Myers, 1997).

The positivist stance has a long historical tradition of using facts and figures, laws, theories to understand a phenomenon (Bhattacherjee, 2012; Hirschheim, 1985). It assumes the traditional

scientific way of treating social observations as an entity supervenient to human interference (Saunders et al., 2016; Tuli, 2010). Taking this stance implies that the researcher is non-influential to the research outcome (Hirschheim, 1985). The positivist relies on the data available in the empirical world, to draw inferences about a phenomenon of interest. The positivist further depends on the verification of theories through testing and aim at producing knowledge that can be generalised based on testing the theory of interest (Orlikowski & Baroudi, 1991; Saunders et al., 2016; Straub et al., 2004). The positivist employs quantitative data tools such as questionnaires/surveys or measuring observable phenomenon in nature for data collection (Johnson & Duberley, 2000; Saunders et al., 2016). Positivists are driven to research by theory and laws of cause and effect (Tuli, 2010).

The stance used in this study was positivist. As explained above, this study was designed to show among other things, an empirical estimation of the relationship and interactions among these constructs – attitude towards water saving, social norms, PBC, exposure to information about the water crisis, knowledge about the need for water-saving, and PIC – through a theoretical model, by using a questionnaire to collect data and analysing the data quantitatively to draw inferences.

I leveraged on the perspective that there exists cross – causality among the above six variables in the literature about how they influence intention to save water (Katz et al., 2016; McKenzie-Mohr & Schultz, 2014; Salvaggio et al., 2014; Schultz et al., 2014; Trumbo & Keefe, 2001, 2005; Witzling et al., 2015) and the fact that objective methods evaluate the measure of their interactions. Thus, I took on an objective approach to the study, whereby, I did not interfere with the responses of the study population and the data collected was tested empirically (Katz et al., 2016; Trumbo & Keefe, 2001; Witzling et al., 2015).

Since testing the effectiveness of the various channels of disseminating the PIC is one of the focal points of this research, the research was conducted experimentally, with three residences as the treatment group and one as the control group. The three residences in the control group received the PIC through SMS, email and both SMS and email, while the control received none.

3.2 Research Methodology

A research methodology is a detailed description of how a researcher plans to conduct valid and credible research (Brewer & Headlee, 2010). These plans include research approach, strategy, and methods (Creswell, 2014). The next sections present my approach, strategy and techniques employed in this research and how they were applied, as well as the justification for their adoption.

3.2.1 Research Approach

There are two approaches to research – inductive and deductive approaches (Bhattacherjee, 2012). By using an inductive approach in research, the goal of a researcher is to infer theoretical concepts and patterns from data by observing a phenomenon of interest (Bhattacherjee, 2012; Otley, 1989; Saunders et al., 2016). The phenomenon of interest being observed must have its cues supported by literature (Saunders et al., 2016). The aim of using an inductive approach in research is to develop a theory after making sense of the observed data through creating themes that emerge from the observed data (Bhattacherjee, 2012; Creswell, 2014). The point above justifies the fact that inductive research is data-driven (Saunders et al., 2016). On the other hand, the deductive approach adopts the use of hypothesis or proposition to empirically verify or validate a theory, law or model (Otley, 1989). A deductive approach to research is, therefore, theory-driven (Saunders et al., 2016).

This research used the deductive approach because I sought to test the conceptual model as well as its predictability as informed by literature and to derive validated evidence to support the conceptual model (Neuman, 2014). I did not intend to build a new model as it is done inductively (Neuman, 2014).

In applying the deductive principles to current research, hypotheses were formed based on literature, which was either supported or unsupported after testing the hypotheses (Bhattacherjee, 2012). Seven constructs derived from the literature aided me in formulating the conceptual model and the six main hypotheses which I tested quantitatively. The presentation of the conceptual model and hypotheses are in the next two sections.

3.2.2. Conceptual Model

In this study, the conceptual model used is an extended TPB (Figure 3.1), following the examples of Clark & Finley (2007) and Trumbo & Keefe (2001). The extension of TPB has been validated in literature by Ajzen (2011) and Armitage & Conner (1999). Ajzen (2011) and Armitage & Conner (1999) suggested that the inclusion of additional variables to TPB can contribute substantially to the theory and its application. Trumbo & Keefe (2005) used information related variables as added variables to the theory and reported that the additional variables had a significant influence on predicting behavioural intention and actual behaviour.

3.2.3 Hypotheses

This section provides the hypotheses that were tested quantitatively.

The Effects of Knowledge and Exposure to Information on TPB Constructs

Knowledge is not one of the main constructs of TPB but has been considered as an important factor in influencing behavioural intentions (Kollmuss & Agyeman, 2002). This is because although having knowledge does not necessarily translate into action, Kollmuss & Agyeman (2002) found that the extent to which an individual is knowledgeable about a phenomenon, for instance, saving water, the more likely such an individual would save water. Because when an individual has knowledge about the desired action, it aids in making a sound decision without coercion (Kollmuss & Agyeman, 2002). The notion above provides the reason why knowledge was included in the conceptual model adopted for this study.

Exposure to information, like knowledge, is not part of the main constructs of TPB. However, at the core of knowledge about a phenomenon, is the level of exposure to information (Kollmuss & Agyeman, 2002). One study that tested and confirmed the relationship between exposure to information and knowledge was the study done by Aprile & Fiorillo (2017). They reported positive associativity between knowledge about environmental behaviour and the exposure to information.

Based on the literature cited above, the hypotheses stated below regarding knowledge about the need for water-saving and the exposure to information about the water crisis was tested.

Hypothesis 1a: Knowledge about the need for water-saving will have a positive effect on attitude.

Hypothesis 1b: Knowledge about the need for water-saving will have a positive effect on social norms.

Hypothesis 1c: Knowledge about the need for water-saving will have a positive effect on perceived behavioural control.

Hypothesis 2a: Exposure to information about the water crisis will have a positive effect on attitude.

Hypothesis 2b: Exposure to information about the water crisis will have a positive effect on social norms.

Hypothesis 2c: Exposure to information about the water crisis will have a positive effect on perceived behavioural control.

Persuasive Information Campaign and its Effect on TPB Constructs

Reaching individuals on a personal level with persuasive information regarding a water crisis and the need to save water has not been previously explored using TPB. This study introduces persuasion as a construct that can be included in TPB to influence students' intention to save water. Information Systems (IS) considers persuasion to be a tool used to achieve attitudinal changes through persuasive systems (Oinas-kukkonen, 2010a). Persuasive systems thrive on a computer-mediated and computer-human persuasive system to drive persuasion (Oinas-kukkonen, 2013). A typical application of a computer-mediated persuasive system is when someone tries to persuade another through one of the following channels – SMS, Instant message, email or social network, while the computer-human system uses a computer that is programmed to automatically drive persuasion through the web (Oinas-kukkonen, 2013). For example, an online store always tries to persuade online shoppers to shop more by suggesting to them more goods following their previous orders or searched items, and also showing feedback from other buyers of similar items. The system presents some deals to further persuade online shoppers to increase their shopping (Fogg, 2003).

Research has shown that persuasion is an effective tool that can increase peoples' behavioural intention in several contexts. For example, in evaluating the behavioural intention of people towards software piracy, Cronan & Al-Rafee (2008) postulated that persuasion could influence an individual's attitude. Similarly, Oinas-kukkonen & Harjumaa

(2008) singled out attitude as a key element on which persuasion attempts to influence individuals' intentions. Katz et al. (2018) and Witzling et al. (2015) noted that using different mediums of communication could have different impacts on individuals' behavioural intention. In this study, it was anticipated that persuasive information disseminated to students on different mediums (SMS, emails or both) would have different impacts on students' intention to save water.

Based on the above, the persuasive information campaign construct will be tested against TPB constructs using the following hypotheses:

Hypothesis 3a: Persuasive information campaign will have a positive effect on attitude.

Hypothesis 3b: Persuasive information campaign will have a positive effect on social norms

Hypothesis 3c: Persuasive information campaign will have a positive effect on perceived behavioural control.

TPB Constructs and their Effects on Intention to Save Water

Attitude is an individual's evaluation of performing a desired behaviour (Beck & Ajzen, 1991). It is one of the major constructs of TPB with a high report of being a major predictor of behavioural intention (Armitage & Conner, 2001; Cronan & Al-Rafee, 2008; Kollmuss & Agyeman, 2002). As a personally driven phenomenon, it can be sharpened by several external and internal factors (Kollmuss & Agyeman, 2002). External factors include economical, institutional, social and cultural while internal factors include motivation, knowledge and values (Kollmuss & Agyeman, 2002). In this study, I considered the knowledge and social influences on attitude.

Social norms are the perceived social pressure an individual has about performing or not performing a desired behaviour; this could be from family, friends, or neighbours and the likes (Ajzen, 1991). Behavioural intentions and actual behaviour are influenced differently by social norms. Brick et al. (2017) and Bernedo et al. (2014) showed that social norms positively influenced the behaviour of residents to save water. Ham et al. (2015) reported that social norms had the weakest relationship with behavioural intention. Ajzen (1991) attributes the weakness of the relationship between social norms and behavioural intention to the fact that

an individual's intentions are personal and internally driven rather than a result of external factors.

Perceived behavioural control is the level of difficulty that an individual attaches to performing a desired behaviour (Ajzen, 1991). It has a strong influence on both behavioural intentions and actual behaviour; hence, the direct link from it to behaviour in the diagram showing TPB (Figure 2.2) (Ajzen, 1991). Due to the rationality of human nature, perceived behavioural control also has a mixed result from studies, but more studies report positive effects than negatives (Ajzen, 1991; Armitage & Conner, 2001).

The following hypotheses were used in this study to confirm or reject the influence that the three independent TPB constructs have on the intention to save water in a higher institution of education.

Hypothesis 4: Attitude towards saving water will be positively associated with the intentions to save water

Hypothesis 5: Social norms will be positively associated with the intentions to save water

Hypothesis 6: Perceived behavioural control will positively influence the intentions to save water

These hypotheses, as illustrated in Figure 3.1, were tested against the research question posed at the beginning of this chapter. Appendix A summarises the operationalisation of constructs.

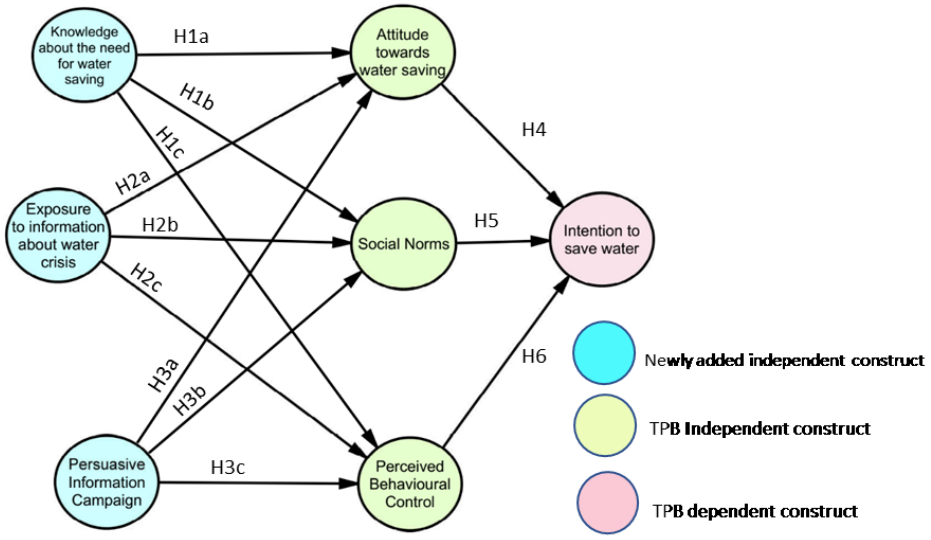

Figure 3.1 Conceptual model showing the hypothetical relationship among variables

3.2.4 Research Strategy and Data Collection Methods

To obtain evidence to test the proposed hypotheses, the research strategy adopted for this study was a survey research strategy. The choice of survey research strategy was to drive the researcher towards answering the research question and attaining the set objectives of the research. A survey research strategy is usually associated with research that is conducted deductively (Saunders et al., 2016). it uses standardised questionnaires or interviews as a tool for collecting data about people's thoughts, behaviours, and preferences in an organised way (Bhattacherjee, 2012; Kraska, 2010). For this study, questionnaires were the tools used for data collection.

The merits of using questionnaires for the study are that they provide an appropriate tool for determining a wide variety of unobservable data, such as people's preferences, attitudes, behaviours, and traits quantitatively. Furthermore, they are void of the researcher's interference with respondents' responses to the questionnaire, and economical for the researcher's time, cost and efforts (Bhattacherjee, 2012). The questionnaire used for this study was administered to all participants (in the selected residences) that make up the study population.

It is worthy of note that the use of questionnaires could have the limitation of common method bias (a bias between the dependent and independent variables) which could potentially confound the inferences drawn by using it (Podsakoff et al., 2003). Common method bias occurs when there is a significant amount of shared variance in both the independent and dependent variables when combined (Podsakoff & Organ, 1986; Urbach & Ahlemann, 2010). To address the problem of common method bias researchers usually conduct Harman's single factor test on a dataset by conducting a factor analysis. The results from the factor analysis are used to confirm whether or not common method bias exist**s** in the data (Malhotra et al., 2006). Harman's single-factor test was applied in this study to check for common method bias. The result of the test showed there was no common method bias in the data used for this study (see chapter four for the results from the tests).

3.2.5 Sample Technique, Population and Research Instrument

A sample refers to a collection of entities (human or non-human) that a researcher selects from a population, to study a phenomenon of interest and generate inferences (Neuman, 2014). The selection process is referred to as a sampling technique (Martin & Bridgmon, 2012; Neuman, 2014). Sampling is important in research because of the unlikelihood of having an entire population participate in research (Saunders et al., 2016). Sampling helps a researcher to utilise resources such as time and budget, which are most of the times constraints in research (Bhattacherjee, 2012). There are two types of sampling techniques – probability and non-probability techniques. Probability sampling technique uses a random selection of a population as a criteria for choosing a sample, while non-probability uses a non-random approach in selecting a sample from a population (Bhattacherjee, 2012; Saunders et al., 2016). An example of probability sampling is a simple random sampling; and an example of non-probability sampling is a purposive sampling (Saunders et al., 2016). Purposive sampling is a sampling technique that a researcher adopts when specific criteria are considered in selecting a sample (Battaglia, 2008; Martin & Bridgmon, 2012). For this study, a non-probability sampling technique was used and precisely, a purposive sampling technique.

A purposive sample of students living in residence with a smart water meter installed was chosen for this study. This was because students water consumption was monitored pre to post-intervention period. A total average of 3,456 students lived the residences with smart water meter during the period of this research (February to April 2019). For representative purposes of the 3,456 students living in residences with SWM, 144 responses were required at a 95% confidence interval with an error margin of 8% for data analysis. Because of the intervention that was administered, four residences were chosen to accommodate the intervention.

The research instrument used for this study was a questionnaire. The development of the questionnaire was to fit the context in which it was administered and to generate the required data needed to answer the research question for this study. Cues from similar studies available in the peer-reviewed literature aided the questionnaire development (Trumbo & Keefe, 2001, 2005; Trumbo et al., 1999; Witzling et al., 2015).

The questionnaire contained closed-ended questions that were used as items to quantify each construct that formed the conceptual model. A five-point Likert scale measured the items – one being the lowest and five being the highest. Below is a brief description of the eight-sectioned questionnaire:

i. **Part one:** This part contained details of the residence in which the respondent resides.
ii. **Part two:** This measured the knowledge about the need for water-saving construct with four items measured by a five-point Likert scale, 1 = strongly disagree and 5 = strongly agree.
iii. **Part three:** This measured the construct on attitude towards water saving with five items measured on the Likert scale of 1 = strongly disagree, and 5 = strongly agree.
iv. **Part four:** This measured the social norms construct with only one item and a Likert scale of 1 = strongly disagree, and 5 = strongly agree.
v. **Part five:** This measured the perceived behavioural control construct with six items on a Likert scale of 1 = strongly disagree, and 5 = strongly agree
vi. **Part six:** This part measured exposure to information, having a total of 12 items and divided into three subsections. (a) Frequency of encountering information about the water crisis and; (b) sources of information had four items; measured on a Likert scale of 1 = Never and 5 = A great deal. (c) channels of receiving information had seven items measured on a Likert scale of 1= Never and 5 Every time
vii. **Part seven:** This measured the persuasion construct with three items on the Likert scale of 1 = Not persuaded and 5 = Highly persuaded
viii. **Part eight:** This part measured the intention to save water with five items measured on a Likert scale of 1 = Never and 5 = A great deal.

A copy of the questionnaire can be found in Appendix B.

3.2.6 Pilot Study

A pilot study is a critical aspect of experimental research. As an initial step, it provides information about the feasibility and validity of the intervention to be investigated (Pena-robichaux et al., 2010). This process helped the researcher to modify the research instrument

used for data collection. It ensures that the research instrument's design is adequate to achieve the objectives of the research (Bhattacherjee, 2012; Fielding et al., 2013).

This research undertook a pilot study on persuasive information campaign by grouping the pilot respondents to the following treatment groups – SMS only, email only, both SMS and email and a control group. The pilot study included the persuasive message to the questionnaire at the point where the questions for the persuasive information campaign construct begins. It asked the respondents to assume they received the information campaign through these mediums – SMS only, Email only, both SMS and Email. They were then requested to respond to the questionnaires based on how they would have responded if they had received such a message through the medium allocated to the respondent's group. The control group did not have a persuasive information campaign included in their questionnaire.

Content of the Message used for the Persuasive Information Campaign in this study

As mentioned earlier in section 2.2, people will respond to a campaign when the message **is** clear, specific, concise, applies to them, emanates from a credible (Dziegielewski, 1991; Ferraro & Price, 2013). Additionally, a message that will be used by an individual or organisation for an effective campaign needs to possess the following qualities: stress the current situation, be motivating, be convincing, be reasonable, indicate how to act, and be fair (Dziegielewski, 1991; Syme et al., 2000). Persuasive messages should have a gentle tone, which could motivate students to reduce their water usage (Katz et al., 2018). These criteria were applied to arrive at the message below:

Dear Water Saving Hero, (motivating)
Dam levels are getting low; the drought is not over. (reasonable and stressing the current situation)
Kindly consider using less than 50L daily. (persuasive, specific and clear)
Shower 5min or less & flush only when necessary. (how to act)
Together, we can. (convincing, motivating and fair)

3.2.7 Ethics

This section provides the ethical considerations considered for this study.

Saunders, Lewis, & Thornhill (2009) defines ethics as the appropriateness of a researcher's behaviour concerning the rights of those who become the subject of the researcher's work

or are affected by it. Research ethics, therefore, relate to questions about how researchers formulate a research topic, design the research, as well as gain access to collect, process, store, analyse data, and write up research findings morally and responsibly without infringing on the rights of their research subjects.

Obtaining Ethics

As part of ethical considerations, the research instrument, methodology, and an application were submitted to the Faculty of Commerce and the Department of Student Affairs of the University of Cape Town for review to carry out this study. Ethics clearance from both Committees, as well as the leadership of the relevant residences where the campaigns were conducted, were obtained before the research commenced. Copies of approved Ethics from the Faculty of Commerce and Department of Student Affairs are in Appendix C1 and C2, respectively.

Consent

A letter of introduction and consent was attached to the questionnaire to introduce the researcher and the study as well as to seek the consent of participants to partake in the study voluntarily. Participants had the freedom of choice to continue or withdraw at any time.

Confidentiality

The details of the participants were anonymous, as the questionnaire did not contain details such as name, gender, and race, or any other personal information. The data relating to the residences were anonymised and uploaded to the UCT Figshare for storage. "Figshare is a research data management & dissemination platform that helps researchers & institutions get credit for all of their research" (Figshare, n.d.).

The Department of Students' Affairs handled the dissemination of the messages and online questionnaire to the students. The researcher never had access to students' details – cell phone numbers or emails addresses – at any point during the research.

Contingencies

Contingencies are unforeseen happenings while conducting research. Some of these contingencies are delayed response to questionnaires and delay to obtain ethics approval. For this research, proactive measures were put into consideration to address these

contingencies. For a possible delayed response to the questionnaire by students, a backup plan of using printed copies of the questionnaire at the student residences was adopted.

Plagiarism

Bhattacherjee (2012) quotes Association for Information Systems (AIS) stance against plagiarism to be a category one ethical violation among others, which includes the falsification of data, research procedures, and data analysis. Therefore, in this research, works from other sources were appropriately referenced.

3.3 Data Collection

The dissemination of the persuasive information campaign was in three experimental groups. The message was disseminated through SMS only, email, and both SMS and email. There was no campaign on the control group; hence they received no message. **I** monitored the water consumption of the residences before disseminating the messages. The observations made during the monitoring phase guided the choice of days and time to disseminate the messages. The messages were disseminated based on the days of the week observed to have the highest rates of water consumption during the monitoring phase as well as the hour of day that recorded the highest consumption over the monitoring period. The days that corresponded with the highest water consumption during the monitoring phase were Wednesdays and Saturdays, and the hour of the day, which corresponded with the highest daily consumption was 7:00 to 8:00 AM. The matching of residence to the channel of message dissemination was done randomly. The campaign schedule is presented in Table 3.1 below:

Table 3.1: Table showing the dates and time when messages were disseminated to students

Original message schedule	Time*
Wednesday, 06 March 2019	07h47
Wednesday, 13 March 2019	07h43
Wednesday, 20 March 2019	06h55
Saturday, 30 March 2019	07h01

*Times are in SAST (+2 GMT)

The administration of the questionnaire to the students was two-fold, an online version using Qualtrics – an online data collection tool – and a printed version. The online version was served online via email to both treatment and control groups through the Department of

Student Affairs. The survey link was sent as a bulk email on 16 April 2019, and the total number of delivered emails was returned as 1,144. The summary of emails sent to the residences is presented in Table 3.2. I used the online platform in the hope of obtaining a high response rate and eliminating the constraints posed by time and costs. The printed copies were as a backup mechanism to follow-up on the online version. Due to delayed response from the online version, a total of 150 printed questionnaires were randomly administered by the researcher to students across the four residences. Each questionnaire had a cover letter that introduced the researcher, the purpose of the research, sought the consent of the respondent to participate in the survey.

Table 3.2: Breakdown of administered survey and responses received per residence

Residences	Online survey sent	Online response	Manual response	Total response
Email only	233	8	32	40
SMS only	234	3	27	30
Both email and SMS	534	9	36	45
Control (No message)	144	2	28	30

The number of responses in Table 3.2 is the final response that was considered for data analysis

A total of 169 responses from both the online and printed versions of the questionnaire (28 from the online version while 131 from the printed version) were received. One hundred and forty-five of the responses were considered valid, and 24 were invalid because of improper completion or less than 50% completed as recommended by Roth (1994). One hundred and forty-five responses satisfied the minimum requirement for the representative purpose (144) as stated above (section 3.2.5).

3.4 Data Analysis Technique

From the questionnaires, the data were pooled and analysed using quantitative tools and techniques (see details in section 3.4.1). Quantitative data collection techniques were used for this study because the questionnaires were structured to quantitatively measure the constructs of the extended Theory of Planned Behaviour on an ordinal (Likert) scale of 1 – 5.

Data Cleaning

Data cleaning is the process of deleting, editing (spellings), or using the average of corresponding variables to input missing values (Davis, 2010). I inputted missing values for five questionnaire responses that had a 75% completion rate, using the average value of each questionnaire item obtained from the completed 140 responses as recommended by Roth (1994). The data collected from Qualtrics (online version) was downloaded in a Comma-Separated Values (.csv) file and cleaned using Microsoft Excel, while the printed version was entered into Microsoft Access before exporting it into an excel file. Both versions of questionnaire were then merged into a single excel file for further analysis using Structural equation modelling in R Statistical Software (R Core Team, 2019).

3.4.1 Structural Equation Model (SEM)

SEM is used to test hypothetical relationships between constructs and aids in gaining deeper insights into the interrelationships that exist among sets of variables in a construct (Anderson & Gerbing, 1988; L. Deng et al., 2018; Hu & Bentler, 1998). It has become a widely used analytical tool for investigating, examining, and understanding the acceptability of a theoretical model adopted by a researcher (Byrne, 2013; Rigdon, 1998). In SEM, the constructs are referred to as latent or unobserved variables (for example in this study one of the latent variables is 'the intention to save water'), whereas the questionnaire items that make up the constructs are known as the indicators, observed or manifest variables, for example, the manifest variables for the intention to save water are 'short showers' and 'using buckets' (L. Deng et al., 2018; Kline, 2015). Figure 3.2 illustrates the typical components of SEM.

Approaches to SEM

There are two approaches to SEM, the covariance-based SEM (CB-SEM) and the Partial Least Squares SEM (PLS-SEM). They have different statistical methods for evaluating theoretical models. The former uses the covariance matrices of observed variables to estimate how a dataset fits a theoretical model tested (Schumacker & Lomax, 2016). The latter is variance-based and seeks to highlight the amount of variance of the dependent variable explained by the data collected using the ordinary least squares estimation approach (Rigdon, 2012). It does this to predict the key constructs of a theoretical model (Ravand & Baghaei, 2016; Rigdon, 2012). The predictive characteristic of PLS-SEM makes it an adequate analytical

approach for empirical studies using SEM, a characteristic lacking in the CB-SEM (Hair Jr. et al., 2014).

The CB-SEM has a firm assumption on the data distribution and sample size while PLS-SEM is not firm on these assumptions, rather it applies the bootstrap method as an alternative to the classical parametric inferential framework used in CB-SEM (Hair et al., 2017; Ringle et al., 2012; Vinzi et al., 2010). Bootstrapping is a technique that employs the use of standard errors and t-statistics to assess the significance of the hypothetical relationships between the latent variables (e.g. the relationship between social norms and the intention to save water) of the structural model (Hair et al., 2011; Urbach & Ahlemann, 2010). PLS-SEM is particularly suitable for studies seeking to understand the increasing complexity of theoretical extension of established theories, comprehensive model – many model relationships, and testing theoretical models with prediction in view (Hair et al., 2019; Johansson & Yip, 1994). Furthermore, the positivist epistemology supports the use of PLS-SEM for data analysis, as the various steps used in evaluating a model is entirely quantitative (Schumacker & Lomax, 2016; Straub et al., 2004; Urbach & Ahlemann, 2010). These characteristics make PLS-SEM an appropriate tool for use in the data analysis for this study. Some cues were taken from Trumbo & Keefe (2001) and Witzling et al. (2015) who also used SEM for the analysis of their data on behavioural intentions.

Model components of SEM

Nachtigall et al. (2003) described a model in SEM as a system of simultaneous equations that use observed or unobserved variables as regressors or criterions interchangeably, which represents the relationships between constructs within a theoretical model. This system of equations in SEM are estimated in the two models that make up SEM –the measurement model and the structural model (Anderson & Gerbing, 1988; Ullman & Bentler, 2013). The model components of SEM are illustrated in Figure 3.2 below.

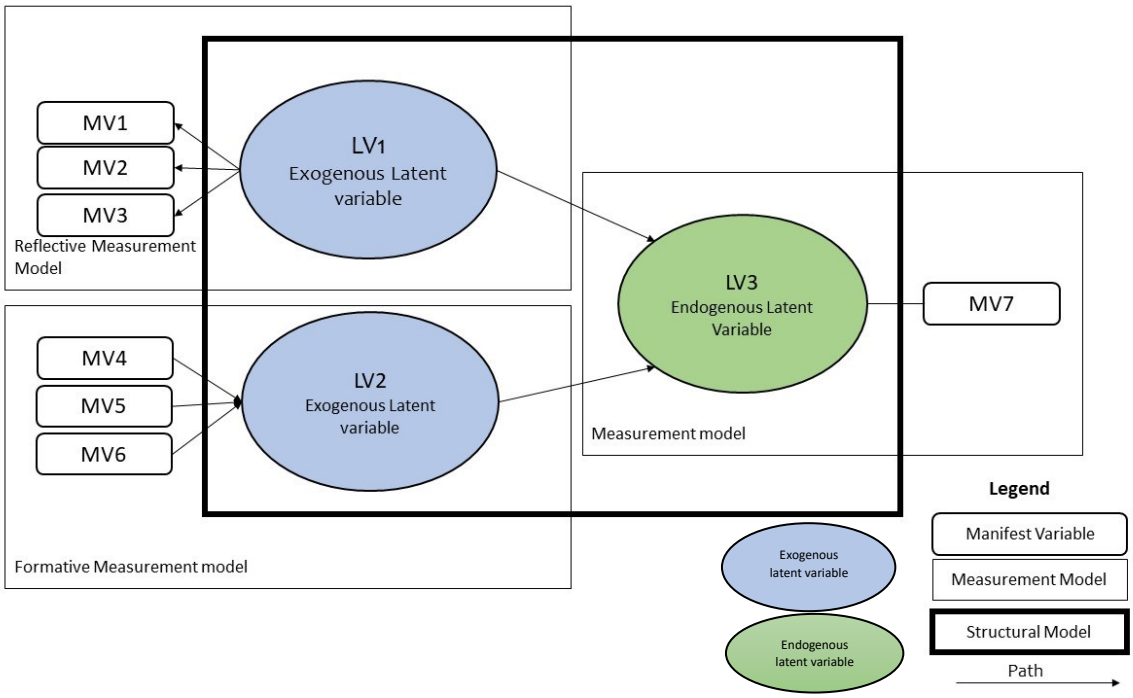

Figure 3.2: Theoretical SEM and constructs

Measurement Model

In the measurement (outer) model, a unidirectional predictive relationship (path – represented by a single-headed arrow) (Figure 3.2) from the manifest variables to the latent variable or vice versa. When the path originates from the manifest variable to the latent variable, the model is referred to as a formative measurement model, and the converse is termed a reflective measurement model (Figure 3.2) (Hair et al., 2011; Tenenhaus et al., 2005). The measurement model has a set of manifest variables (Figure 3.2) which act collectively as a variate to define the latent variable (Hair Jr. et al., 2009). The measurement model is the model used for evaluating reliability and validity (discussed in few sections away from this) of the underlying theoretical model (Boomsma et al., 2012; Hair Jr. et al., 2009). This study used a reflective measurement model.

Structural model

The structural model (inner model) shows the relationships (paths) among the latent variables in an underlying model (Chin, 1998). Latent variables with paths (represented by a single-ended arrow) from other latent variables are endogenous variables, and the latent variables without any path pointing to them are exogenous variables (Figure 3.2) (Hair et al., 2011). The structural model typically represents the hypothetical relationships in an underlying

theoretical model, and such relationships could either be direct or indirect (Vinzi et al., 2010). It also depicts the dependent and independent variables of the model (Hair Jr. et al., 2009). The structural model serves as the driving power of PLS-SEM because of the multi regressions that it runs to determine the predictive power of the model (Nachtigall et al., 2003).

PLS-SEM Algorithm

The basic PLS-SEM algorithm follows the traditional three-stage approach by Lohmoller (1989). In the first stage, the measurement model estimates are determined iteratively by partial regression, where the manifest variables are the determinants of the latent variables (Lohmoller, 1989; Vinzi et al., 2010). In the second stage, the ordinary least squares regressions are determinants of the path coefficients, and the third stage is the path estimation. These make the path modelling procedure "partial least squares" (Hair et al., 2011, 2019; Vinzi et al., 2010). Table 3.2 shows the stages of PLS-SEM algorithm.

Table 3.2: Table showing PLS-SEM algorithm

Stage 1:	Iterative estimation of weights and Latent Variable scores Starting at Step #4, repeat steps #1 to #4 until convergence 1. Inner weights 2. Inside approximations 3. Outer weights a) In a Mode A Block (Reflective) b) In a Mode B Block (Formative) 4. Outside approximation
Stage 2:	Estimation of path and loading coefficients
Stage 3:	Estimation of location parameters

Software for Running PLS-SEM

With the increasing adoption of PLS-SEM in data analysis by different disciplines (Hair et al., 2017), the earlier software (LVPLS 1.6) developed in the 1980s by Lohmoller (1989) has seen the emergence of more user-friendly software with graphical interphases in the markets (Hair et al., 2017). Some of these are SmartPLS (Ringle et al., 2005), WarpPLS (Kock, 2015), XLSTAT (Chin, 1998), and different R statistical packages (Monecke & Leisch, 2012).

R is among the robust statistical packages used in carrying out analysis in multidisciplinary fields in recent years, because of its availability and accessibility as free, open-source

software. It is also operating system friendly (works well on either Microsoft Windows, UNIX or MAC OS), data-visualisation competent, and diverse in its analytical capability (Cheng, 2010; Crawley, 2013; Sanchez, 2013). PLS-SEM can be performed in R using two packages, the semPLS (Monecke & Leisch, 2012) and plspm (Sanchez, 2013). R statistical software (R Core Team, 2019) was the analysis software used to analyse the cleaned data. PLS-SEM package (plspm) in R Statistical Software was used for the data analysis in this study to evaluate the models examined.

3.4.2 Evaluating the Models of SEM

As captured in 3.4.1 above, the two models for evaluation in SEM are the measurement and structural models. The sections below describe the evaluation processes.

3.4.2.1 Evaluating the Measurement Model

The first stage of the PLS-SEM algorithm focuses on the measurement model. As earlier captured, the model in this study is reflective. Reflective models use internal consistency, indicator reliability, convergent validity (average variance extracted), and discriminant validity for model evaluation (Hair et al., 2011; Sarstedt et al., 2016).

Internal Consistency Reliability

Internal consistency reliability – also referred to as composite reliability (CR) – is the first step in evaluating the measurement model. The calculation of Cronbach alpha values determines the level of internal consistency reliability on a scale of 0 – 1 (0 is worst while 1 is best) (Vinzi et al., 2010), with 0.60 the minimum Cronbach α value considered to be acceptable for exploratory research (Schumacker & Lomax, 2004). An additional determinant of internal consistency is called Dillon-Goldstein's ρ (DG ρ). DG ρ is part of the plspm package; it has a minimum acceptable value of 0.70 (Sanchez, 2013; Vinzi et al., 2010). DG ρ is recommended in literature to be a better criterion to evaluate internal consistency reliability, Cronbach α tends to understate the reliability of items in a latent variable block (Chin, 1998; Teo, 2009). In addition to DG ρ, the eigenvalues of the latent variables add credence to the internal reliability consistency. To be considered valid, the first eigenvalue of the latent variable must be greater than 1.

Indicator Reliability

Indicator reliability, also known as item reliability, is the magnitude of the outer loadings of a measurement model (Hair et al., 2017). For an item (manifest variable) to be considered as having a significant loading, it typically should have a value of 0.70 (Hair et al., 2011). However, values above 0.60 are considered acceptable (Hulland, 1999).

Convergent Validity

Convergent validity is measured as Average Variance Extracted (AVE). Chin (1998) defines it as "the amount of variance that a latent variable captures from its indicators relative to the amount due to measurement error." The minimum value expected for the latent variable is 0.50 (Hair Jr. et al., 2017; Kock, 2015), implying that the latent variable explains more than 50 per cent of its manifest variables (Hair et al., 2011).

Discriminant Validity

To ensure that latent variables do not have redundant manifest variables or have correlations with other latent variables' items in the underlying model, a discriminant validity test is performed (Hulland, 1999). The Fornell-Larcker approach was used for this study, and it assumes that the latent variable shares more variance with its manifest variables than with any other latent variable in the model (Hair Jr. et al., 2014). To test for discriminant validity using the Fornell-Larcker method, the square root of a latent variable's AVE has to be higher than correlational scores of any other latent variable in the model (Fornell & Larcker, 1981; Hair et al., 2017). The results of the test are presented in chapter four.

3.4.2.2 Evaluating the Structural Model

Ensuring the credibility of the results obtained from the evaluation of the measurement model is of high importance, as these results will present the requisite variables in the assessment of the structural model (Hair et al., 2017). The assessment of the structural model proves or disproves the hypothesised relationships (Hair Jr. et al., 2014). Coefficient of determination (R^2), path coefficients, and Goodness of Fit (GoF) are the required criteria for evaluating the structural model (Hair Jr. et al., 2014; Urbach & Ahlemann, 2010). The next three sections discuss these criteria briefly.

Coefficient of Determination (R^2 value)

The coefficient of determination, R^2, represents the cumulative effect of the exogenous variables on the endogenous variables (Hair Jr. et al., 2014). It is the predictive power of the model measuring from 0 (weak) to 1 (perfect), the greater the value of R^2, the more predictive power the model exerts and vice versa (Hair Jr. et al., 2014). The acceptable R^2 threshold values in literature are 0.02 (small), 0.13 (medium), 0.26 (large) values over 0.26 represents very large predict power (Akter et al., 2011; Cohen, 1988).

Path Coefficients

Path coefficients (β) are the estimates obtained after running a PLS-SEM model; the estimates represent the hypothesised paths connecting the latent and manifest variables (Hair Jr. et al., 2014). The estimates obtained are standardised values usually from -1 to +1, with values closer to -1 showing strong negative relationships and values closer to +1 showing a stronger positive relationship (Hair et al., 2017). Urbach & Ahlemann (2010) posited that in a model testing, a hypothesis with an initial prediction of a positive relationship before the analysis commences is null and void if the analysis returns a negative β. This position is irrespective of whether or not the negative β is significant or not. β also indicates the magnitude of a hypothetical relationship (Urbach & Ahlemann, 2010).

Goodness of Fit (GoF)

GoF serves as a criterion of validating a PLS model globally (Tenenhaus et al., 2005). The mathematical representation of GoF is:

$$\text{GoF} = \sqrt{\overline{AVE}\ X\ \overline{R^2}}$$

Where $\overline{AVE}$ represents the mean of the Average Variance Extracted (AVE), $\overline{R^2}$ represents the mean R^2 of the endogenous variable. Using the R^2 values as derived by Cohen (1988) R^2 = 0.02 (small), R^2 = 0.13 (medium), R^2 = 0.2 (large); and Fornell & Larcker (1981)'s minimum AVE of 0.5, GoF threshold values of 0.1 (small), 0.25 (medium), and 0.36 (large) are generally accepted (Akter et al., 2011; Wetzels et al., 2009).

Application of SEM in the current study

Underlying this study are the proposed hypotheses about the relationships among six latent variables (attitude towards water-saving, social norms, perceived behavioural control,

exposure to information about water crisis, knowledge about the need for water-saving, and persuasive information campaign) that are assumed to have a direct or indirect influence on students' intention to save water. According to the recommendation by Anderson & Gerbing (1988), there is a need to evaluate and make meaningful inferences of the relationships and influences among the manifest variables and latent variables, respectively. Chapter four shows the results of the evaluated models.

3.5 Chapter Summary

This chapter discussed the various methods adopted for the study and why. The chapter further explained the philosophical stance which pointed to the research approach, strategy, paradigm, and analytical techniques used for the study.

Chapter Four: Data Analysis and Results

Analytical research instruments (dataset) must go through sufficient data validation procedures. Undergoing these procedures will make the inferences from the analysis more meaningful (Straub et al., 2004). This chapter presents the results of the validation procedures and data analysis.

4.1 Checking for Common Method Bias

The potential bias to the validity of the research instrument used in this study was the common method bias. Literature asserts that Harman's single factor test is the most widely used and more credible test for detecting common method bias in a dataset (Kahle & Malhotra, 1994; Podsakoff & Organ, 1986; Urbach & Ahlemann, 2010). Harman's single factor test uses factor analysis to test for the presence of common method bias in a dataset. A common method bias exists in a dataset if a single factor emerges from the result of factor analysis, or if the first component from the factor analysis explains more than 50% of the variance in the variables tested (Podsakoff & Organ, 1986). The Harman's single factor was used to check if common method bias exists in the data set used in this study.

A factor analysis was conducted with the 34 items of the questionnaire (Appendix B) to carry out Harman's single-factor test. Eleven items returned eigenvalues greater than one (Table 4.1), with the first component having a variance of 18.97%, a value far less than 50% (Table 4.1). Thus, satisfying the two conditions for Harman's single-factor test (i.e. more than one item was returned, and none of the items returned in Table 4.1 has a variance of 50% or more) confirming that common method bias does not exist in the data.

Table 4.1 Eigenvalues for the factor analysis conducted for the Harman's single-factor test

Component	Eigenvalue	Proportion Total Variance	Cumulative proportion
1	6.45	18.97	18.97
2	3.26	9.60	28.57
3	2.14	6.28	34.86
4	2.07	6.08	40.94
5	1.85	5.46	46.40
6	1.56	4.59	50.99
7	1.43	4.21	55.20
8	1.21	3.55	58.75
9	1.15	3.39	62.14
10	1.11	3.26	65.40
11	1.03	3.02	68.42

4.2 Analysis of the Developed Model

A validation process was performed on the dataset to ensure that both the measurement and structural models satisfy the condition to proceed with the data analysis, as discussed in chapter three. Although Partial Least Square Path Modelling is sample friendly, a recommended threshold of 60 samples is good sample size for conducting a standard PLS-SEM analysis (Chin, 1998). The sample size for this study is 145, which exceeds the threshold of 60 samples required for a PLS-SEM analysis. The sections below present the results from the analysis of the measurement and structural model.

4.2.1 Evaluation of Measurement Model

Internal Consistency Reliability Test

Dillion-Goldstein's rho (DG ρ) and the eigenvalue were the evaluation criteria used to measure internal consistency reliability in this study. Table 4.2 presents the results. The values of DG rho are above 0.7; the values range from 0.820 to 1 and eigenvalues from 1.000 to 2.550. These results show that the constructs have good internal consistency reliability.

Table 4.2: Result showing internal consistency of latent variables

Latent variables (constructs)	Key	MVs*	DG rho	First eigenvalue
Knowledge about the need for water-saving	KWN	4	0.820	2.130
Exposure to information about water crisis	INF	2	0.847	1.470
Persuasive information campaign	PIC	3	0.906	2.290
Attitude towards water saving	ATT	4	0.874	2.550
Social Norms	SN	1	1.000	1.000
Perceived Behavioural Control	PBC	3	0.826	1.840
Intention to save water	ISW	2	0.840	1.450

*MVs = Manifest Variables

Item Reliability

To ensure that the manifest variables are reliable, their outer loadings should typically be up to 0.7, but loadings of between 0.4 to 0.7 are valid especially if the manifest variables are essential to the latent variable block (Birkinshaw et al., 1995; Fornell & Larcker, 1981; Hair Jr. et al., 2017; Hulland, 1999). Researchers are expected to delete manifest variables that do not meet this criterion from the latent variable block (Hair et al., 2011; Wang et al., 2018). Thirty-

four manifest variables were evaluated in this study (Appendix B), and 17 manifest variables were retained for further analysis. Sixteen had outer loadings greater than 0.7 (Appendix D1). One manifest variable, "ShortShower" whose loading was 0.677 was kept under the intention to save water construct because of its importance to the latent variable (Hair et al., 2017; Hulland, 1999). Dropping the manifest variables that were below the required values increased the composite reliability as expected (Hair et al., 2017). The breakdown of the manifest variables used, and the ones dropped are in Appendix D1 and D2, respectively.

Convergent Validity

Composite reliability (CR), Average Variance Extracted (AVE), and factor loadings are the parameters used for the evaluation of convergent validity. As previously stated, the accepted values for CR, AVE and factor loadings are 0.7, 0.5 and 0.6, respectively. In this study, these criteria were satisfied as CR, AVE and factor loadings ranged from 0.820 to 1.000, 0.531 to 1.000, and 0.677 to 1.000 respectively. CR and AVE are captured in Table 4.3, while Appendix E captures the factor loadings.

Table 4.3: Table showing the evaluation of convergent validity

Latent Variables	MVs	CR	AVE
Knowledge about the need for water saving	4	0.820	0.531
Exposure to information about water crisis	2	0.847	0.734
Persuasive information campaign	3	0.906	0.747
Attitude towards water saving	4	0.874	0.628
Social Norms	1	1.000	1.000
Perceived Behavioural Control	3	0.826	0.607
Intention to save water	2	0.840	0.692

Discriminant Validity

The discriminant validity determinant for this study was the Fornell-Larcker criterion. The Fornell-Larcker criterion assumes that the square root of the AVE has to be greater than the correlational scores of other latent variables (Chin, 1998; Fornell & Larcker, 1981). Table 4.4 shows the square root of the AVE on the diagonal, which is greater than all the correlation

scores of other constructs that are on the same row or column (Henseler et al., 2015). Thus, validating the discriminant validity of the measurement model.

Table 4.4: Table showing Discriminant Validity

	KNW	INF	PIC	ATT	SN	PBC	ISW
KNW	**0.729**						
INF	0.161	**0.857**					
PIC	0.273	0.175	**0.864**				
ATT	0.692	0.213	0.352	**0.792**			
SN	0.081	0.206	0.135	0.294	**1.000**		
PBC	0.370	0.218	0.209	0.228	0.105	**0.779**	
ISW	0.390	0.185	0.382	0.381	0.061	0.213	**0.832**

4.2.2 Evaluating the Structural Model

The structural model typically represents the hypothetical relationships in an underlying theoretical model, and such relationships could either be direct or indirect. The path coefficients that determined the magnitude of the relationships between the exogenous latent variables (e.g. knowledge about the need for water-saving) and endogenous latent variables (e.g. attitude towards water-saving), the coefficient of determinant (R^2) and the goodness of fit model were all estimated by the plspm package.

I used the total, direct and indirect effects to gain more insight into the path coefficients, especially for the endogenous variable. A path with a coefficient greater than 0.2 was considered to be significant at a 99% confidence interval ($p < 0.01$) as observed in the study by Chin (1998). Figure 4.1 shows the path coefficients and R^2 values of the structural model for the analysis in this study, and the sections below the figure describe the results of the testing of the hypotheses captured in section 3.2.3.

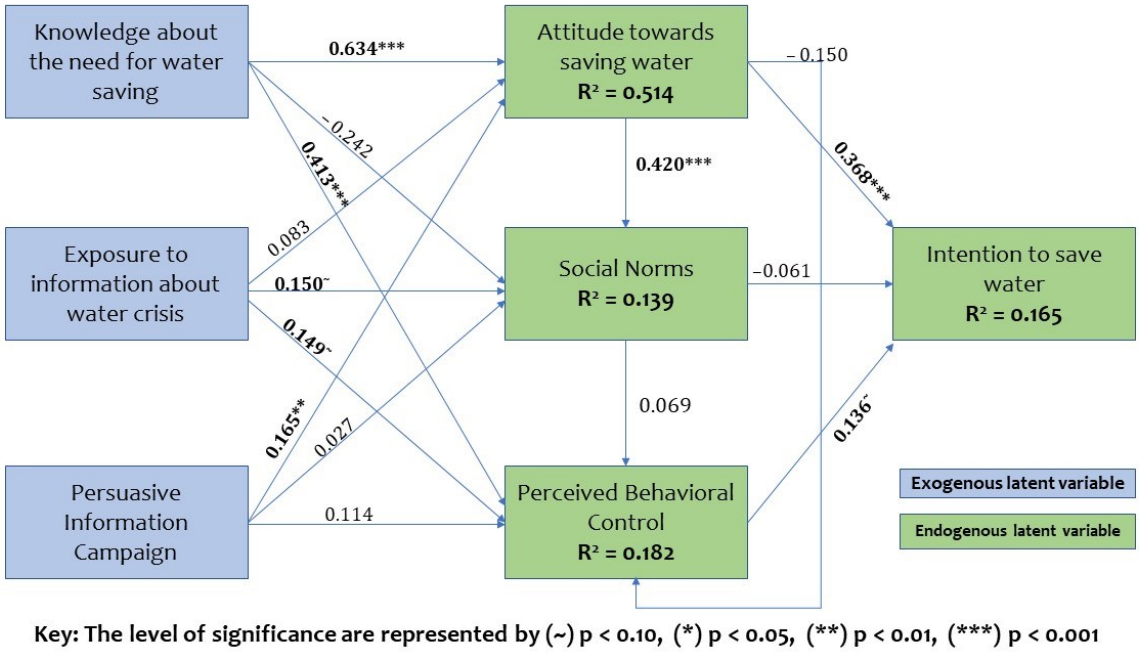

Figure 4.2: Extended TPB model showing path coefficients, significance level and R^2 Values of the structural model of the extended Theory of Planned Behaviour used for this study

Hypotheses Testing

H_{1a}, H_{1b}, H_{1c} Knowledge about the need for water-saving will have a positive effect on the three TPB construct (attitude, social norms and perceived behavioural control)

Knowledge about the need for water-saving had three hypotheses linked to the three TBP constructs – attitude, social norms, and perceived behavioural control. Knowledge about the need for water-saving had a substantial magnitude (β = 0.634) and a significant positive effect on students' attitudes towards water saving (Table 4.5 and Figure 4.2). Hence hypothesis 1_a which states that *knowledge about the need for water-saving will have a positive effect on attitude towards water-saving* is supported and therefore accepted. The knowledge about water-saving had a large magnitude (β = -0.242) with a significant negative relationship with social norms (Table 4.5 and Figure 4.2). Hence, hypothesis 1_b , which states that *Knowledge about the need for water-saving, will have a positive effect on social norms* is unsupported because of the negative relationship as posited by Urbach & Ahlemann (2010). The Knowledge about the need for water-saving had a large magnitude (β = 0.413) and a significant positive effect on perceived behavioural control (Table 4.5 and Figure 4.2) as

predicted by hypothesis 1_c. Hypothesis 1_c which states that *Knowledge about the need for water-saving will have a positive effect on perceived behavioural control* is therefore accepted.

Table 4.5: Summary of hypotheses showing the effects of knowledge about water-saving on the three TPB constructs

Hypothesis	Path	β	P(t) values	Remark
H_{1a}	Knowledge -> Attitude	0.638	**0.000 (10.3) *** **	Supported
H_{1b}	Knowledge -> Social norms	-0.242	**0.028(-2.22)**	Unsupported
H_{1c}	Knowledge -> perceived behavioural control	0.413	**0.000(3.810) *** **	Supported

|˜P < 0.1 ||* P < 0.05 | | P < 0.01 | |*** P < 0.001|**

|˜P < 0.1 | is included as a significance level in concert with Benitez et al. (2019) and McKnight et al. (2017).

H_{2a}, H_{2b}, H_{2c} Exposure to information about the water crisis will have a positive effect on the three TBP constructs

Three hypotheses related to the effects of exposure to information about the water crisis on the TBP constructs were tested. Exposure to information about the water crisis had a very small magnitude (β=0.083) and an insignificant effect on students' attitude towards water-saving (Table 4.6 and Figure 4.2). Hence, hypothesis 2_a, which states that *the exposure to information about the water crisis, will have a positive effect on attitude* was unsupported. The exposure to information about water crisis had a weak magnitude (β=0.150) and a marginally positive significant effect on social norms (Table 4.6 and Figure 4.2). Hence, hypothesis 2_b, which states that the e*xposure to information about the water crisis will have a positive effect on social norms* was marginally supported. And *Hypothesis* 2_c which states that the e*xposure to information about the water crisis will have a positive effect on perceived behavioural* control was marginally supported because the exposure to information about water crisis had a weak magnitude (β=0.149) and a marginally positive effect on perceived behavioural control (Table 4.6 and Figure 4.2).

Table 4.6: Summary of the hypotheses showing the effects of the exposure to information about the water crisis on the three TBP constructs

Hypothesis	Path	β	P(t) values	Remark
H_{2a}	Exposure to information -> Attitude	0.083	0.171(1.380)	Unsupported
H_{2b}	Exposure to information -> Social norms	0.150	**0.065(1.860) ˜**	Marginally Supported
H_{2c}	Exposure to information -> perceived behavioural control	0.149	**0.065(1.860) ˜**	Marginally Supported

|˜P < 0.1 ||* P < 0.05 | | P < 0.01 | |*** P < 0.001|**

H_{3a}, H_{3b}, H_{3c} Persuasive information campaign has a positive effect on the three TPB constructs

There were three hypotheses about the effect of persuasive information campaign. The first one is Hypothesis 3_a, and it states that *Persuasive information campaign will have a positive effect on attitude.* Persuasive information campaign had a medium magnitude (β=0.164) and a significant positive effect on attitude towards water-saving (Table 4.6 and Figure 4.2). Hence the hypothesis was supported. Hypothesis 3_b states that *Persuasive information campaign will have a positive effect on social norms*. This hypothesis was unsupported because Persuasive information campaign had a small magnitude (β=0.027) and an insignificant effect on social norms (Table 4.7 and Figure 4.2). The last was Hypothesis 3_c; it states that *Persuasive information campaign will have a positive effect on perceived behavioural control*. Persuasive information campaign had a weak magnitude (β=0.114) and an insignificant positive effect on students perceived behavioural control (Table 4.7 and Figure 4.2). Hence, the hypothesis was not supported.

Table 4.7: Summary of the hypotheses showing the effects of a persuasive information campaign on the three TBP constructs

Hypothesis	Path	β	P(t) values	Remark
H_{3a}	Persuasive information campaign -> Attitude	0.164	**0.008 (2.670) ****	Supported
H_{3b}	Persuasive information campaign -> Social norms	0.027	0.754 (0.314)	Unsupported
H_{3c}	Persuasive information campaign -> perceived behavioural control	0.114	0.170 (1.380)	Unsupported

|˜P < 0.1 ||* P < 0.05 | | P < 0.01 | |*** P < 0.001|**

H_4, H_5, H_6 TPB constructs have a positive effect on the intention to save water

The three primary TPB constructs had a hypothesis each to be tested. The hypothesis on the attitude towards water-saving is hypothesis 4 and states that *Attitude towards saving water will be positively associated with the intentions to save water*. Attitude towards saving water had a substantial magnitude (β=0.368) with a significant and positive effect (p< 0.001) on the intention to save water (Table 4.8 and Figure 4.2). The hypothesis was supported. Hypothesis 5 states that *Social norms will be positively associated with the intentions to save water.* Social norms had a very small magnitude (β = -0.061) with an insignificant and negative effect (p=.449) on the intention to save water (Table 4.8 and Figure 4.2). The hypothesis was unsupported. The final hypothesis was hypothesis 6, and it states that *Perceived behavioural control will positively influence the intentions to save water.* Perceived behavioural control had

a medium magnitude (β =0.136) with a significant and positive effect (p=0.088) on the intention to save water (Table 4.8 and Figure 4.2). Therefore, the hypothesis was marginally supported.

Table 4.8: Summary of hypotheses showing the effect of attitude on the intention to save water

Hypothesis	Path	β	P(t) values	Remark
H_4	Attitude -> intention to save water	0.368	**0.000 (4.470) *** **	Supported
H_5	Social norms -> intention to save water	-0.061	0.449 (-0.760)	Unsupported
H_6	Perceived behavioural control -> intention to save water	0.136	**0.088 (1.720) ˜**	Marginally supported

|˜P < 0.1 ||* P < 0.05 | | P < 0.01 | |*** P < 0.001|**

Table 4.9: Summary of hypotheses tested

Hypothesis	Remark
Hypothesis 1a	Supported
Hypothesis 1b	Unsupported
Hypothesis 1c	Supported
Hypothesis 2a	Unsupported
Hypothesis 2b	Marginally Supported
Hypothesis 2c	Marginally Supported
Hypothesis 3a	Supported
Hypothesis 3b	Unsupported
Hypothesis 3c	Unsupported
Hypothesis 4	Supported
Hypothesis 5	Unsupported
Hypothesis 6	Marginally Supported

Direct, indirect and total effects of major constructs on the intention to save water

Table 4.10 presents the direct, indirect, and total effects of major constructs on the intention to save water.

Table 4.10 Summary of direct, indirect and total effects of major constructs on the intention to save water

	Direct effects				Indirect effects				Total effects			
	ATT	SN	PBC	ISW	ATT	SN	PBC	ISW	ATT	SN	PBC	ISW
KNW	0.634***	-0.242	0.413***			0.266***	-0.093	0.275***	0.634***	0.025	0.319***	0.275***
INF	0.083	0.150˜	0.149˜			0.035	0.000	0.039	0.083	0.185*	0.150˜	0.039
PIC	0.165**	0.027	0.114			0.069	-0.018	0.068	0.165**	0.096	0.096	0.068
ATT		0.420***	-0.150˜	0.368***			0.029	-0.042		0.420***	-0.121	0.326***
SN			0.069	-0.061				0.009			0.069	-0.052
PBC				0.136˜								0.136˜

|˜P < 0.1 ||* P < 0.05 | | P < 0.01 | |*** P < 0.001|**

Attitude towards saving water had the highest loading for the direct and total effects on intention to save water having a value of 0.362 with $p < 0.001$ (very high significance level), implying that students' intention to save water was impacted very significantly by their attitude towards water saving (Table 4.10). The next construct, which significantly affected students' intention to save water was students' knowledge about the need for water-saving. It had an indirect and total effect loading of 0.275 with $p < 0.01$ (high significance level) (Table 4.10), suggesting that knowledge about the need for water-saving indirectly influenced students intention to save water, and finally, perceived behavioural control was the least significant construct with a direct and total effect loading of 0.136 (Table 4.10).

Knowledge about the need for water-saving had the highest direct and total effect loading of 0.634 on attitude towards saving water and 0.413 on perceived behavioural control, while attitude towards saving water had a direct and total effect on social norms with loading of 0.420 (Table 4.10).

The goodness of Fit (GoF) Model

As mentioned previously, GoF values are categorised as GoF = 01 (small), GoF = 0.25 (medium), and GoF = 0.36 (large). The GoF value obtained for this study was 0.401, implying that the model is considered a valid model and has a better prediction power when compared to the

baseline GoF threshold. This further implies that the model can be implemented to motivate students' intention to save water in their residences.

Validating the Coefficient of Determination (R^2)

R^2, as previously discussed, is an essential measurement model criterion, which represents the cumulative effect of the exogenous variable on the endogenous. Table 4.11 presents the R^2 values of the endogenous variables for this analysis.

Table 4.11: Summary of the Coefficient of determination (R^2 values) for the endogenous variables

Endogenous variable	R^2
Attitude towards water saving	0.514
Social Norms	0.139
Perceived behavioural control	0.182
Intention to save water	0.165

From the results of the analysis presented in Tables 4.10 and 4.11, only two constructs, persuasive information campaign and knowledge about the need for water-saving, had direct effects on attitude towards saving water and explained 51.4% of the variance (R^2=0.514). Attitude towards saving water was the only variable that had a direct positive effect on social norms, and it explains 13.9% of the variance (R^2=0.139). Knowledge about the need for water-saving and exposure to information about water crisis were the constructs with a direct effect on Perceived behavioural control and explained 18.2% of the variance (R^2=0.182). Attitude towards saving water and perceived behavioural control accounted for 16.5% of the variance for students' intention to save water. Applying the measurement criterion for R^2 by Cohen (1988) 0.02 (small), 0.13 (medium), 0.26 (large), the model is considered good due to the magnitude of the variance estimation by each endogenous variable in the inner model.

4.4 Chapter Summary

This chapter presented a summary of the dataset. The chapter also showed the results of the various tests conducted for the reliability and validity of the dataset, and the evaluation of both the measurement and structural models. The results obtained from testing the 12 hypotheses returned four that were fully supported, three as marginally supported, and five as unsupported. In conclusion, the model was evaluated using the GoF and R^2 value and was considered a valid model.

Chapter Five: Discussion of Findings and Conclusion

This chapter presents the key findings based on the research question put forward at the beginning of the research. The research design aided to answer the research question: To what extent does a persuasive information campaign disseminated through affect students' intention to save water? The objectives of the study were met except for not successfully comparing the water consumption pre to post-intervention period as intended due to inconsistent logging of data by some of the smart water meters of the residences used.

5.1 A Recap of the Study

A conceptual model – extended Theory of Planned Behaviour – was developed and used to answer the research question. The conceptual model originated from the popular Ajzen's (1991) Theory of Planned Behaviour, a theoretical model which is well-known for behavioural studies (Kollmuss & Agyeman, 2002). The original model proposes that a behavioural intention precedes actual behaviour. The behavioural intention has three independent constructs – attitude, social norms, and perceived behavioural control (Ajzen, 1991). The conceptual model used for this study had three independent constructs added to the three basic independent TPB constructs (attitude, social norms and perceived behavioural control). The newly added constructs include exposure to information about the water crisis, knowledge about the need for water-saving, and persuasive information campaign. The conceptual model hence had seven constructs in total – six independent constructs and one dependent construct (intention to save water) (figure 5.1). From the seven constructs, twelve hypotheses were formulated to evaluate the effect of a persuasive information campaign on students' intention to save water.

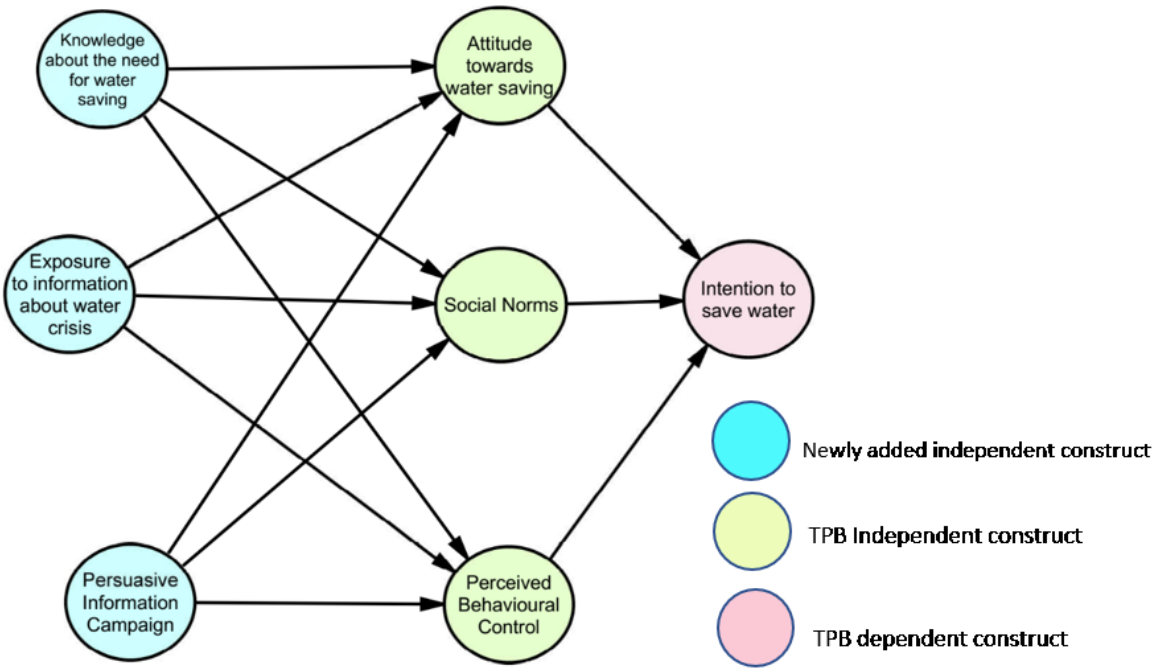

Figure 5.1: Conceptual Model – Extended Theory of Planned Behaviour

To evaluate the conceptual model as well as test the hypotheses, data were collected from four student's residence at the University of Cape Town and analysed with the Partial Least Squares Structural Equation Modelling (PLS-SEM) using plspm package (Sanchez, 2013) in R statistical software (R Core Team, 2019). The choice of PLS-SEM was because of its suitability to understand the complexity of theoretical extension and its predictive ability. Chapter four presented the results from the data analysis. The evaluation of the measurement and structural models followed the generally accepted standards recommended in the literature. A reliability test was performed on the dataset to ensure that the dataset meets the criteria for analysis.

The structural model evaluation showed the following effects: knowledge about the need for water-saving had the largest effect on attitude towards water-saving (β= 0.634, p< 0.001, t-value= 10.300). Knowledge about the need for water-saving also had a large effect on perceived behavioural control (β= 0.413, p< 0.001, t-value= 3.810). Exposure to information about the water crisis had a small to moderate effect on social norms, which was marginally significant (β= 0.150, p= 0.65, t-value= 1.860). Exposure to information about the water crisis also had a moderate effect on perceived behavioural control that was marginally significant (β= 0.149, p= 0.065, t-value= 1.860). Persuasive information campaign had a small to moderate

effect on attitude towards water-saving, which was statistically significant (β= 0.165, p= 0.008, t-value= 2.670). Attitude towards water-saving had a moderate to large effect on social norms (β= 0.420, p< 0.001, t-value= 3.730). Attitude towards water-saving had a moderate to large effect on intention to save water (β= 0.368, p< 0.001, t-value= 4.470). knowledge about the need for water-saving had a large but negative effect on social norms (β = -0.242, p= 0.028, t-value= -2.220). Social norms had no effect on intention to save water (β= -0.061, p= 0.449, t-value= -0.760). Perceived behavioural control had a small to moderate effect on the intention to save water, which was marginally significant (β= 0.136, p= 0.088, t-value= 1.720).

Attitude towards water-saving, knowledge about the need for water-saving, and perceived behavioural control were the constructs with the highest, second-highest, and third highest significant effects respectively on students' intention to save water. The R^2 value for the endogenous variables of the proposed conceptual model was large enough to substantiate the model. Therefore, the research was able to achieve its desired aim to show the prediction power of the model. The sections below interpret these results and how they relate to other literature.

5.2 Discussion on Findings

5.2.1 The Effect of the Model Constructs on Students' Intention to save Water

Knowledge about the need for water-saving

Four items defined knowledge about the need for water-saving - KNW1 to KNW4, and they all had high factor loadings. KNW2 (which sought to find out if the students are aware that UCT needs to reduce its water consumption by 50% due to the water crisis) had the highest loading of 0.744. KNW3 ("I have a role to play in reducing UCT's overall water consumption") had the next highest loading of 0.731. KNW4 ("reducing my water consumption can contribute to UCT's goal of reducing water consumption by half") had a loading of 0.724. KNW1 testing the knowledge of students about the water crisis in Cape Town loaded lastly with 0.716. These loadings confirm that the students were fully aware of the water crisis, the need to save water as well as the fact that they had a role to play in achieving UCT's goal of reducing water consumption at least by 50%. This confirms the assumption that the students already have knowledge about the need for water-saving and proves that the information campaign

embarked on by UCT was indeed effective in creating awareness about the need to save water.

Students' knowledge about the need for water-saving had the largest effect on attitude towards water-saving (β= 0.634, p< 0.001, t-value= 10.300) and had a total indirect effect (β= 0.275, p< 0.001) on students' intention to save water. Attitude towards water-saving then had a large effect on students' intention to save water (β= 0.368, p< 0.001, t-value= 4.470). These results are similar to other studies (Aprile & Fiorillo, 2017; Witzling et al., 2015). The study by Clark & Finley (2007) found that knowledge about drought was influential to the adoption of water conservation policy by the residents of Bulgaria. This implies that residents evaluated the need for adopting the water conservation policy as a positive development, and this was attributed to the amount of knowledge residents possessed.

Knowledge about the need for water-saving also had a substantial effect on perceived behavioural control (β= 0.413, p< 0.001, t-value= 3.810). The results from the hypotheses testing revealed that students' knowledge about the need to save water had a large effect on their perceived behavioural control as expected. Surprisingly, social norms were negatively affected by knowledge. This result is interesting because this suggests that as students' knowledge about the need for water-saving increases, their social norms decreases. The students did not feel the pressure from their colleagues to increase their intention to save water. This could be as a result of students' internal drive, motivated by their knowledge about the need for water-saving. However, the students' Social norms construct was not significantly related to students' intention to save water (discussed below). Witzling et al. (2015), in their study, found that knowledge about aquatic invasive species prevention had a significant positive effect on perceived behavioural control of farmers. The result from this study corroborates each other to show that knowledge is an important factor to attitudinal change and perceived behavioural control.

Exposure to Information about the Water Crisis

Exposure to information about the water crisis from the results showed that it had a positive effect on social norms and perceived behavioural control, but the effects were only marginally significant. The item that had the highest loading on the exposure to information construct was "friends" (0.866). This questionnaire item measured how frequent students

were exposed to information about the water crisis by their friends, and the next high loading was "family" (0.847). This item measured how frequently students are exposed to information about the water crisis by their family members. This factor loading confirms what Fielding et al. (2013) postulated in their study, i.e. exposure to information could be a predictor of social norms.

The effect of exposure to information on social norms and perceived behavioural control aligns partially with the results from Witzling et al. (2015). In their study, the effect of exposure to information was mixed as specific channels of being exposed to information were positively associated with perceived behavioural control. For instance, signage was positively associated with perceived behavioural control and negatively affected by social norms. However, information from social clubs negatively correlated to attitude. In another study by Trumbo & Keefe (2005), exposure to information had a significant positive relationship with attitude and social norms which is reported here as having no significant effect and a weak significance, respectively. Generally, based on the mixed results from several studies, the effect of exposure to information on social norms and perceived behavioural control may be more complicated than thought and may require further investigation.

Persuasive Information Campaign (PIC)

PIC was a new construct included in the extended TPB model in this study. The reason for adding persuasive information campaign as a new construct was to test whether persuasion could increase the intention of students to save water. Cronan & Al-Rafee (2008) and Katz et al. 2018 suggested that PIC could increase people's attitude towards saving water. However, this suggestion has not been previously tested, especially in the context of an institution of higher education. Even the information campaigns conducted in households were mostly norm-based for examples see Seyranian, Sinatra, & Polikoff (2015) and Schultz et al. (2014), assertive or suggestive (Katz et al., 2018) rather than persuasive.

This study tested the recommendation by Cronan & Al-Rafee (2008) and Katz et al. 2018. The analysis revealed that the persuasive information campaign conducted had a significant positive effect on attitude towards water-saving which in turn affected students' intention to

save water confirming that persuasion can indeed positively influence people's attitude towards water-saving.

Testing the effect of each of the channels (email, SMS, email and SMS) through which students received the persuasive messages was one of the focus areas of this study. This approach aimed at testing the effect of persuasion and how any of these channels influence students' attitude and encouraged them to increase their intention to save water.

The item for the group that received the message both by SMS and email had the highest loading (0.907). The next was the group that received the message by SMS alone (0.845) while the group that received the message by email alone had the least loading (0.839). This factor loading suggests that combining both SMS and emails have the highest effect, followed by SMS and then email. However, the differences in these loadings were not very large, suggesting that the effect of persuasion to increase the intention to save water was high among the three groups. The highest effect of both SMS and email could be attributed to how the students personally considered the emphasis of the message – receiving the message on two personal channels (Gurol-Urganci et al., 2013; Russell et al., 2018). A study that compared the effect of SMS and email in marketing reported that SMS had a more significant effect on customers' intention to purchase products than an email (Rettie et al., 2005). In another study where SMS and email were used to access students' performance, Humphrey et al. (2019) reported that students who received course updates through SMS performed better than those who received course updates through email. Muench & Baumel (2017) noted the reason why SMS seems to be a more efficient channel of engaging with people than email is because people are quick to open or read their SMS more than they would an email. Combining the high effects of SMS and moderate effect of emails as described above could be one of the reasons why students who received the PIC on both channels had the highest effect. Another reason for the observed high loadings in this study may be due to the environment where this research took place was educated; where access to the internet is continuously available. Hence, the respondents may have access to digital media at no extra cost as they would their SMSs. This scenario may be the complete opposite in another context where access to the internet to enable frequent access to emails is hampered (Reback et al., 2018). Achieving attitudinal change without coercion recommended by Oinas-kukkonen & Harjumaa's (2009) was supported in this study.

5.2.2 Effect of TPB Constructs on the Intention to Save Water

Attitude Towards Saving Water

Attitude is the favourable or unfavourable evaluation of the intended action to be performed by an individual. The attitude construct in this study refers to students' attitude towards water saving, and five items measured it. The item that had the highest loading was ATT2 (0.829). This item measured how important they think it is for them to use less water now to avoid water shortages. The next item that had high loading was ATT1 (0.819); it measured the students' belief of how important it is to save water. The next item with high loading was ATT5 (0.768); this measured how morally obligated they felt to use water judiciously. The least loading of the five items measuring attitude towards saving water was ATT3 (0.75). ATT3 measured how they believe their intentional saving of water by just a little amount can make a big difference in the UCT community.

The results from the analysis in this study showed that attitude towards saving water had the largest, positive significant effect on intentions to save water by students (β=0.343, t-value=4.470, p-value < 0.001). This result is very consistent with available literature that attitude has a large positive significant effect on behavioural intention. In the study by Untaru et al. (2016), attitude towards water-saving had the strongest effect on the intentions to conserve water in a lodging context. Similarly, Armitage & Conner (2001)after an extensive review of the literature reported a strong general effect of attitude on behavioural intention. Also, in a study conducted by Cronan & Al-Rafee (2008), the attitude construct was the most significant predictor of the behavioural intention for not participating in software piracy. In the same vein, Lowe et al. (2015) reported the positive effect of attitude on the intention to consume less water in households.

Students' attitude towards saving water was influenced very significantly by the knowledge they already possessed on the need to save water (β=0.634, t-value=10.300, p-value < 0.001) and by the persuasive information campaign conducted in this study (β=0.164, t-value=2.670, p-value = 0.008), implying that keeping students well informed on water crisis and water-saving as well as persuading them are paths that can influence their attitudes. A positive influence on attitude to save water could then influence the intention to save water because

students' positive evaluation of saving water is a very crucial driver of intentions to save water.

Social Norms

One of the main constructs of the TPB evaluated in this study is social norms. Social norms are the perceptions an individual has arising from the individual's social sphere - family, friends or neighbours. It is a measure of the perceived personal or social values, and also an individual's opinion on how other group members will socially judge an individual if such individual engages in a certain behaviour (Schultz et al., 2014). Although the respondents in this study appeared to have been exposed to water-saving information from their friends and family members, as discussed under the section on exposure to information above, social norms as a construct did not have a significant effect on their intention to save water in this study (β=-0.061, t-value=-0.760, p-value = 0.449). This result differs from the finding by Brick et al. (2017). In their study, social norms had a significant effect on residential water conservation efforts; where households were socially influenced to reduce their water consumption by up to 208 litres monthly. The significant effect observed by the authors could have been due to the fear or feeling of a household being viewed as socially irresponsible because of high water consumption when compared with their neighbours. This study did not however, use comparison of water consumption as part of the social norm construct. The effect of social norms observed in this study could further be explained by Ajzen (1991); he noted that the weakness of the social norms construct on behavioural intention may be because an individual's intentions are strongly influenced by personal and internal motivation rather than external factors. This phenomenon could be the reason why the effect of knowledge about the need for water-saving had a significant negative effect on students' social norms in this study. Thus, suggesting that the influence of knowledge about the need for water-saving originated from students' rather than pressures from friends and family. Other studies that showed a weak association or complete dissociation between the social norms and behavioural intentions are the studies by Armitage & Conner (2001) and Cooper (2017); Pollard (2015) respectively.

The findings from the current study corroborate result by Pollard (2015) who found that social norms did not influence people's intention to save computer energy at work. Pollard (2015) attributed the insignificant effect of social norms on the intention to the possibility of the

strong effect perceived behavioural control had on the intention to save computer energy at work. The insignificant effect of social norms on the intention to save water may also be due to perceived behavioural control. This outcome is so because the students' sense of being in control of saving water is stronger than societal or external influences. It appears that ultimately, the intention to save water by students is not affected by what their colleagues think of them saving water but what they are determined and choose to do based on the knowledge they have.

Perceived Behavioural Control

Perceived behavioural control is the level of difficulty that an individual attaches to performing a required behaviour (Ajzen, 1991). In this study, the perceived behavioural control construct had six items. Only three of the six items measuring PBC returned with an acceptable item loading. The item with the highest loading was PBC5 (0.829) which measured how students perceive that the repairing of leakages could complement their effort on saving water in residence. The item with the next high loading was PBC4 (0.796), this item measured whether students think the CoCT should find new sources of water for the city, rather than for people to reduce the amount of water they use. The item with the smallest acceptable loading was PBC6 (0.707), this measured how easy it would be for the students in residence to save water. The overall analysis showed that perceived behavioural control had a little to medium effect on the intention to save water that is marginally significant (β=0.136, t-value=1.720, p-value = 0.088).

There are mixed results of perceived behavioural control on behavioural intention found in literature, with some studies reporting no effect, others weak to large effects (Ajzen, 1991; Armitage & Conner, 2001; Fishbein & Ajzen, 2011). For example, while Cooper (2017) showed that the effect of perceived behavioural control on behavioural intentions towards price restriction on water tariffs was positively significant, Chen (2016) did not observe a significant relationship between perceived behavioural control and behavioural intentions. The positive effect of perceived behavioural control on the intention of students to save water reported in this study is similar to the findings from the study by Deng et al. (2016).

Intention to Save Water

A person's intention captures the motivational factors that influence the person's behaviour and emphasises that intentions are indications of how hard people are willing to try and how much effort they are planning to exert, to perform the behaviour (Ajzen, 1991). Five items measured the intention to save water in this study but only two of the five items loaded with acceptable values. The two items are "Using buckets" with the highest loading of (0.962) representing the use of buckets provided by UCT for the collection of greywater for reuse and "Short Shower" (0.677) representing taking short showers. This implies that students were willing to use the buckets provided by UCT and take short showers to save water in their residences.

The meta-analysis on the contributions of TPB constructs on behavioural intention by Armitage & Conner (2001), showed that attitude and perceived behavioural control are the main predictors of behavioural intention with social norms typically having a weak effect on behavioural intention. In this study, a similar pattern evolved as attitude had the strongest effect on students' intentions to save water, followed by perceived behavioural control while social norms construct had no significant effect on the intention to save water. This result is also corroborated by the findings of Cronan & Al-Rafee (2008) and Lam (1999), where the only significant components predicting the intention, not to pirate software were attitude, and perceived behavioural control.

5.3 The Contribution made by this Study

This study has contributed to theory and practice in the following ways:

Theoretical Contribution

A conceptual model was developed using the Theory of Planned Behaviour as the base model. The conceptual model was applied in this study to investigate the antecedents of intention to save water by students in an institution of higher education. In the conceptual model, a novel construct – persuasive information campaign (using SMS, email, and both SMS and email) – was included. It significantly influenced students' attitude towards saving water, which in turn had the strongest effect on their intention to save water.

To the researcher's knowledge, this is the first study conducted using the persuasive information campaign as a novel construct to TPB and in the context of a higher institution of education. Most studies accessed in literature carried out such studies with households, farms and hotels. Additionally, PLS-SEM was the method of data analysis used for the study, which is also rare in literature for TPB and its application. Most studies that used the SEM approach used the CB-SEM approach for data analysis. Figure 5.1 shows the significant path coefficients of the model.

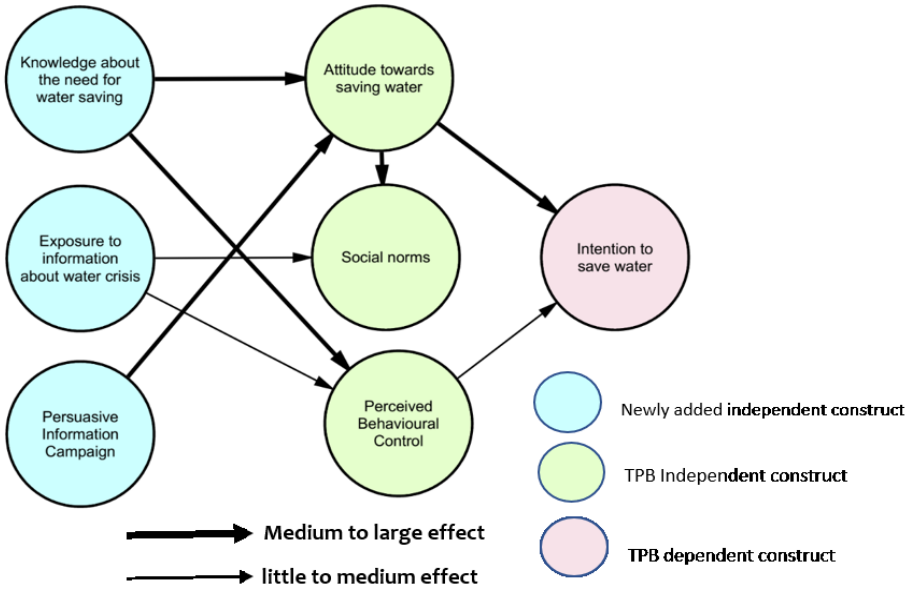

Figure 5.2: The extended Theory of Planned Behaviour showing the significant predictors of intention to save water

Practical Implications to a Higher Institution of Education.

The proposed model for this study has been able to present three predictors of students' intention to save water from the aspects of both direct and indirect effects. The three main predictors of intention to save water are the attitude towards water saving, knowledge about the need for water-saving and perceived behavioural control. The model showed that 16.5% of the variance was explained mainly by these three constructs. The two ways students intend to save water from the results were using buckets to collect water for reuse and through taking short showers. Water collected for reuse saves a significant amount of water, especially when used for flushing toilets.

Taking cues from how students' intended to save water, it is recommended that the University management should consider practical ways by which students may reuse water in their residences. This could be achieved by installing water recycling systems in student residences. The recycling systems can make water from laundry and baths reusable, especially for flushing toilets.

It is recommended that the UCT residence leadership or University management maintain an increased level of education and awareness about the need for water-saving in students' residences through a persuasive information campaign and other information campaign types using emails and SMS, as the effect of knowledge about the need for water-saving and persuasive information campaign on students' attitudes plays a very significant role in attitudinal change.

5.4 Conclusion

The negative effects of freshwater shortages globally are on the increase, and ways to mitigate these effects and optimize the available freshwater for socio-economic activities need also to increase. People need to be adequately informed of how they can contribute to the sustainability of freshwater as a resource. With adequate knowledge, frequent reminders through information campaigns and incorporating the use of technology, managers could gain cooperation from water users to reduce water consumption. This study has shown how SMS and emails can be used in students' residences in an institution of higher education to further drive attitudinal change through a persuasive information campaign, which in turn influences the intention to save water. As an ongoing effort to attain water conscious and sustainable university, the impact of the interventions implemented so far and those planned for implementation in the future would position the university as a leading water conscious and sustainable university in the long run.

5.5 Limitations and Recommendation for Further Study

The objectives for this research were to carry out a persuasive information campaign and to measure how the campaign conducted using SMS, email and both SMS and email influenced students' intention to save water – these objectives were achieved. The research design for this study included a plan to observe the actual water consumption of students pre to post-

intervention. The observation of water consumption was to enable a comparison of water consumption before during and after the campaign. Unfortunately, the smart water meters in some of the residences were faulty, and the recording of water consumption was not consistent during the intervention phase, and efforts to retrieve unlogged data from the smart water meter vendor were unsuccessful. This technical fault prevented a follow-up analysis of the persuasive information campaign on the actual water consumption by students which could have potentially accounted for any additional effects of the persuasive information campaign that the questionnaire was not able to capture. The observed R^2 value 16.5% accounting for the intention to save water from the model, is an indication that other factors are underlying that this study could not capture.

The study was limited to only students' residences at UCT that had smart water meters installed. At the time of this study, smart meters were being installed in student residences across the University; this could have impacted the findings of this study as well. Given that this study was cross-sectional focusing on intention to save water, it is recommended that a longitudinal study be conducted to capture the overall effect of a persuasive information campaign on the actual behaviour of UCT students. This study could also be expanded by involving more higher institutions of education in the region and beyond to generate more insight on how students in higher institutions respond to a persuasive information campaign to help achieve water-saving goals and/or other issues requiring students' cooperation by management. Other potential areas of research include investigating the effect of faulty smart water meters to managers or users as a feedback mechanism. Methodologically, the study can be replicated with (i) various campaign types to multiple campaigning channels, and (ii) various campaign types to one campaigning channel; instead of one campaign type to multiple campaign channels as adopted in this study.

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Lists of Appendix

Appendix A: Operationalisation of constructs

Construct in theory	Construct in this study	Source
Attitude (Ajzen, 1991)	Attitude towards saving water	(Ajzen, 1991; Trumbo & Keefe, 2001, 2005; Untaru et al., 2016)
Social norms (Ajzen, 1991)	Social norms	(Ajzen, 1991; Clark & Finley, 2007)
Perceived behavioural control (Ajzen, 1991)	Perceived behavioural control	(Ajzen, 1991; Clark & Finley, 2007; Trumbo & Keefe, 2001)
	Knowledge about water-saving	(Salvaggio et al., 2014; Witzling et al., 2015)
	Exposure to information about water crises	(Syme et al., 2000; Trumbo & Keefe, 2001; Witzling et al., 2015)
	Persuasive information campaign	(Cronan & Al-Rafee, 2008; Oinas-kukkonen, 2010b)
Behavioural intention	Intention to save water	(Ajzen, 1991; Trumbo & Keefe, 2001, 2005)

Appendix B: Copy of questionnaire administered for the study

Department of Information Systems
Leslie Commerce Building, Upper Campus
Private Bag. Rondebosch 7701 Tel: +27 (0) 21 650 4028 Fax: +27 (0) 21650 2280 Internet: http://www.commerce.uct.ac.za/informationsystems

Dear colleague,

I am a full-time Masters' student of the Department of Information Systems at the University of Cape Town. I am carrying out a study entitled "The effect of a persuasive information campaign on students' intention to save water". The study has been approved by the Ethics in Research Committee of the Faculty of Commerce, University of Cape Town.

The purpose of this study is to determine the extent to which persuasive information campaign can further encourage students to reduce their water consumption in the university. Your participation in this research will be highly appreciated.

You are not obligated to provide any specific identifiable information for this survey and your participation is completely voluntary. All information will be treated confidential and used for the purpose of this study only. The findings of this study will be compiled and presented to the University of Cape Town for academic purposes.

Participants' details will not be published as part of the report and all participants will remain anonymous. The questionnaire will take approximately 10 minutes to complete. If you have any query, kindly contact me on azakij@gmail.com or 0634466546.

☐ I hereby indicate my willingness to participate in this research.

Thank you for your time.

Yours sincerely,

Azaki Joshua I
Masters Student
Department of Information Systems
Email: azakij@gmail.com

Prof. Ulrike Rivett
Research Supervisor
Department of Information Systems
Email: ulrike.rivett@uct.ac.za

S/N	code	Questionnaire Items	Strongly disagree	Disagree	Partly agree	Agree	Strongly agree
Knowledge about the need to save water							
1.	KNW1	The City of Cape Town is still faced with water crisis.					
2.	KNW2	The University of Cape Town needs to reduce overall water consumption by at least 50%.					
3.	KNW3	I have a role to play in UCT's overall water consumption.					
4.	KNW4	Reducing my water consumption can contribute to UCT's goal of reducing water consumption by half.					
Attitude towards water saving							
5.	ATT1	I believe it is important to reduce water consumption.					
6.	ATT2	It is important that I always reduce water consumption to avert water shortages.					
7.	ATT3	If I reduce the amount of water I consumption by just a little, it will make a big difference for the UCT community.					
8.	ATT4	I should use no more water in the residences than is necessary.					
9.	ATT5	I feel a moral obligation to use water carefully.					
Social Norms							
10.	SN	My colleagues think it is important to reduce water consumption					
Perceived Behavioural Control							
11.	PBC1	There is something students can do to avoid water shortage in the city.					
12.	PBC2	There is need to reduce water consumption in our residence.					
13.	PBC3	The things we do to save water around the student residence make significant difference for the community.					
14.	PBC4	It would be better to find new sources of water for the city, than for people to reduce the amount of water they use.					
15.	PBC5	When leaks in the water supply network are repaired, it contributes to reduced water consumption at residence.					

16.	PBC6	It would be very easy for my residence to reduce the amount of water we use.					
Exposure to information about water crisis							
		Frequency of receiving Information	**Never**	**Rarely**	**Occasionally**	**A moderate amount**	**A great deal**
17.	*INFEXP1*	How frequent do you encounter information about water crises?					
		How often have you received such information from the following sources?					
18.	CoCT	City of Cape Town.					
19.	UCT	University of Cape Town					
20.	Frnds	Friends					
21.	Fam	Family members					
		Channels of exposure to information about water crises	**Never**	**Rarely**	**Occasionally**	**Almost every time**	**Every time**
22.	NewsP	Newspaper					
23.	TV	Television					
24.	PrintM	Print media (banner, poster, sticker, brochure etc)					
25.	Radio	Radio					
26.	SocialM	Social media (twitter, Facebook, WhatsApp, Instagram etc)					
Persuasive Information Campaign			**Not persuaded**	**Partially persuaded**	**Neutral**	**Somewhat Persuaded**	**Highly persuaded**
27.	Email	After receiving the message, through how persuaded were you to increase your intention to save water?					
28.	SMS	How persuaded were you after receiving the message by SMS?					

29.	Both	How persuaded were you after receiving the message by both Email and SMS?					
Intention to Save Water							
How do you intend to act after receiving the message you received?			**Never**	**Rarely**	**Occasionally**	**A moderate amount**	**A great deal**
30.	ShortShower	Taking shorter showers					
31.	FlushLess	Not flushing the toilet after every use.					
32.	FLWmachine	Using the washing machine more efficiently (only running it with a full load)					
33.	OffTapBrush	Turning off the tap while brushing teeth.					
34.	Ubukets	Using the buckets provided by UCT for grey water collection?					

Appendix C1: Approved Ethics from the Faculty of Commerce

Faculty of Commerce

Private Bag X3, Rondebosch, 7701
2.26 Leslie Commerce Building, Upper Campus
Tel: +27 (0) 21 650 4375/ 5748 Fax: +27 (0) 21 650 4369
E-mail: com-faculty@uct.ac.za
Internet: www.uct.ac.za
@Commerce UCT **UCT Commerce Faculty Office**

19 November 2018

Mr Joshua Azaki
Department of Information System
University of Cape Town

Dear Joshua Azaki,

REF: REC 2018/011/142

The effect of a persuasive information campaign on students' intention to save water.

We are pleased to inform you that your ethics application has been approved. Unless otherwise specified this ethical clearance is valid for 1 year and may be renewed upon application.

Please be aware that you need to notify the Ethics Committee immediately should any aspect of your study regarding the engagement with participants as approved in this application, change. This may include aspects such as changes to the research design, questionnaires, or choice of participants.

The ongoing ethical conduct throughout the duration of the study remains the responsibility of the principal investigator.

We wish you well for your research.

Modie Sempu
Administrative Assistant
University of Cape Town
Commerce Faculty Office
Room 2.26 | Leslie Commerce Building

Office Telephone: +27 (0)21 650 4375
Office Fax: +27 (0)21 650 4369
E-mail: modie.sempu@uct.ac.za
Website: www.commerce.uct.ac.za<http://www.commerce.uct.ac.za/

Appendix C2: Approved Ethics from the Department of Student Affairs UCT

	RESEARCH ACCESS TO STUDENTS	DSA 100

NOTES

1. This form must be **FULLY** completed by all applicants who want to access UCT students for the purpose of research or surveys.
2. Return the fully completed **(a) DSA 100** application form **by email,** in **the same word format,** together with **your: (b) research proposal inclusive of your survey, (c) copy of your ethics approval letter / proof (d) informed consent letter** to: Moonira.Khan@uct.ac.za. You application will be attended to by the Executive Director, Department of Student Affairs (DSA), UCT.
3. The turnaround time for a reply is **approximately 10 working days**.
4. NB: It is the responsibility of the researcher/s to apply for and to obtain **ethics approval and to comply with amendments that may be requested;** as well as **to obtain** approval to access UCT staff and/or UCT students, from the following, at UCT, respectively: (a) **Ethics**: Chairperson, Faculty Research Ethics Committee' (FREC) for ethics approval, (b) **Staff access:** Executive Director: HR for approval to access UCT staff, and (c) **Student access:** Executive Director: Student Affairs for approval to access UCT students.
5. **Note:** UCT Senate Research Protocols requires compliance to the above, **even if prior approval has been obtained from any other institution/agency. UCT's research protocol requirements applies to *all* persons, institutions and agencies from UCT and external to UCT who want to conduct research on human subjects for academic, marketing or service related reasons at UCT.**
6. **Should approval be granted to access UCT students for this research study, such approval is effective for a period of one year from the date of approval (as stated in Section D of this form), and the approval expires automatically on the last day.**
7. **The approving authority reserves the right to revoke an approval based on reasonable grounds and/or new information.**

SECTION A: RESEARCH APPLICANT/S DETAILS

Position	Staff / Student No	Title and Name	Contact Details (Email / Cell / land line)
A.1 Student Number	AZKJOS001	Mr Joshua Azaki	azkjos001@myuct.ac.za / 0634466546
A.2 Academic / PASS Staff No.			
A.3 Visitor/ Researcher ID No.			
A.4 University at which a student or employee	University of Cape Town	Address if *not* UCT:	
A.5 Faculty/ Department/School	Faculty of Commerce/Department of Information Systems		
A.6 APPLICANTS DETAILS If different from above	Title and Name	Tel.	Email

SECTION B: RESEARCHER/S SUPERVISOR/S DETAILS

Position	Title and Name	Tel.	Email
B.1 Supervisor	Professor Ulrike Rivett	+27216504213	Ulrike.rivett@uct.ac.za
B.2 Co-Supervisor/s			

SECTION C: APPLICANT'S RESEARCH STUDY FIELD AND APPROVAL STATUS

C.1 Degree – if applicable	Masters
C.2 Research Project Title	The effectiveness of a persuasive information campaign on student's intention to save water
C.3 Research Proposal	Attached: Yes [■] No [ ]
C.4 Target population	UCT Students
C.5 Lead Researcher details	If different from applicant:
C6. Will use research assistant/s	Yes [ ] No [■] If yes- provide a list of names, contact details :
C.7 Research Methodology and Informed consent	**Research methodology**: Quantitative survey **Informed consent:** Yes, advised to students
C.8 Ethics clearance status from UCT's Faculty Ethics in Research Committee /Chair (EiRC)	Approved by the UCT EiRC: Yes [■] With amendments: Yes [■] No [ ] (a) Attach copy of your UCT ethics approval. Attached: Yes [■] No [ ] (b) State date / Ref. No / Faculty of your UCT ethics approval: 20/11/2018 Ref. /Faculty.: REC 2018/011/142

SECTION D: APPLICANT/S APPROVAL STATUS FOR ACCESS TO STUDENTS FOR RESEARCH PURPOSE

(To be completed by the UCT - ED, DSA or Nominee)

	Approved / With Terms / Not	* Conditional approval with terms	Applicant/s Ref. No.:
D.1 APPROVAL STATUS	(i) Approved [■] ~~(ii) With terms~~ ~~(iii) Not approved~~	a) Access to students for this research study must only be undertaken after written ethics approval has been obtained. *b)* In event any ethics conditions are attached, these must be complied with before access to students.	AZKJOS001 / Mr Joshua Azaki

	Designation	Name	Signature	Date of Approval
D.2 APPROVED BY:	Executive Director Department of Student Affairs	*Dr Moonira Khan*		*27 November 2018*

Appendix D1: Item loadings for item consistency reliability

OUTER MODEL

	Weight	Loading	Communality
Knowledge			
Knw1	0.322	0.716	0.512
Knw2	0.395	0.744	0.553
Knw3	0.329	0.731	0.535
Knw4	0.342	0.724	0.525
Exposure			
Frnds	0.548	0.866	0.751
Fam	0.502	0.847	0.718
PersuasiveIC			
Email	0.318	0.839	0.704
SMS	0.308	0.845	0.713
PIC	0.513	0.907	0.823
Attitude			
Att1	0.293	0.819	0.671
Att2	0.332	0.829	0.687
Att3	0.38	0.75	0.562
Att5	0.381	0.768	0.59
SocialNorms			
SN	1.012	1	1
PerceivedBC			
PBC4	0.322	0.796	0.633
PBC5	0.463	0.829	0.687
PBC6	0.386	0.707	0.499
Intention			
Shortshower	0.339	0.677	0.459
Ubukets	0.634	0.962	0.925

Appendix D2: Dropped Manifest Variables and their description

Latent Variable	No of MVs before analysis	No of MVs after analysis	No of MVs dropped	Description of MVs dropped
KNW	**4**	**4**	**0**	
INF	10	2	8	InfoFreq: How frequent do you encounter information about water crises?
				CoCT: How frequent do you receive information about water crises through the City of Cape Town
				UCT: How frequent do you receive information about water crises through UCT?
				Newspaper: How frequent do you receive information about water crises through newspaper?
				TV: How frequent do you receive information about water crises through television?
				PrintMedia: How frequent do you receive information about water crises through print media (banners, poster, sticker etc)?
				Radio: How frequent do you receive information about water crises through radio?
				SocialMedia: How frequent do you receive information about water crises through social media (twitter, facebook, whatsapp etc)?
PIC	3	3	0	

ATT	5	4	1	ATT4: I should use no more water than is necessary.
SN	1	1	0	
PBC	6	3	2	PBC1: There is something students can do to avoid water shortage in the city.
				PBC2: There is need to reduce water consumption in our residence
				PBC3: the things we do to save water around the student residence makes a significant difference for the community.
ISW	5	2	3	FlushLess: How do you intend to save water by flushing the toilet less frequently
				FLWmachine: How do you intend to save water by using the washing machine efficiently (only running it with a full load)
				OffTapBrush: How do you intend to save water by turning off the tap while brushing teeth?

Appendix E: Factor Loadings for the Outer Model

Cross-loadings of manifest variables (questionnaire items)

	Knowledge	Exposure	PersuasiveIC	Attitude	SocialNorms	PerceivedBC	Intention
Knowledge							
1 Knw1	**0.716**	0.129	0.232	0.453	0.009	0.276	0.263
1 Knw2	**0.744**	0.056	0.263	0.481	0.199	0.249	0.367
1 Knw3	**0.731**	0.164	0.171	0.521	-0.044	0.292	0.309
1 Knw4	**0.724**	0.134	0.114	0.574	0.043	0.266	0.179
Exposure							
2 Frnds	0.099	**0.866**	0.154	0.155	0.245	0.176	0.100
2 Fam	0.180	**0.847**	0.147	0.213	0.103	0.197	0.221
PersuasiveIC							
3 Email	0.177	0.186	**0.839**	0.231	0.130	0.157	0.230
3 SMS	0.244	0.088	**0.845**	0.207	0.095	0.191	0.285
3 Both	0.268	0.170	**0.907**	0.401	0.123	0.192	0.414
Attitude							
4 Att1	0.618	0.127	0.180	**0.819**	0.152	0.161	0.325
4 Att2	0.583	0.266	0.282	**0.829**	0.165	0.214	0.320
4 Att3	0.513	0.119	0.239	**0.750**	0.290	0.187	0.237
4 Att5	0.497	0.177	0.381	**0.768**	0.267	0.156	0.335
SocialNorms							
5 SN	0.081	0.206	0.135	0.294	**1.000**	0.105	0.061
PerceivedBC							
6 PBC4	0.353	0.122	0.137	0.195	-0.065	**0.796**	0.145
6 PBC5	0.284	0.198	0.124	0.145	0.127	**0.829**	0.247
6 PBC6	0.242	0.174	0.242	0.211	0.144	**0.707**	0.075
Intention							
7 Shortshower	0.358	0.163	0.393	0.327	0.035	0.113	**0.677**
7 Ubukets	0.341	0.164	0.317	0.340	0.061	0.217	**0.962**

Appendix F1: Table showing the water restrictions and its water related activity implemented by the CoCT

Water restriction level	Water-related activities									
	Watering of home gardens etc. with municipal drinking water	Watering of gardens after rainfall	Watering gardens in parks and open spaces with an alternative water source	display of signage where alternative water is in use	Application for exemption by special users (golf courses and schools)	Topping-up swimming pool	Ornamental water fountains	Washing of car with hosepipe with municipal drinking water	Litres per day per person	Fined for excess water usage
Level 1										
Level 2	Thrice per week for one hour before 9H00 & after 16H00	Allowed after 24 hours	Thrice per week before 9H00 and after 16H00	Compulsory	Allowed	Not allowed, except with a non-permeable pool cover	Allowed where features are operated by recycling water	Allowed when hosepipe has automatic self-closing devices		
Level 3	Twice per week before 9H00 & after 18H00	Allowed after 48 hours	Twice per week (Tuesday & Saturday) for one hour before 9H00 and after 16H00	Compulsory	Allowed	Not allowed, except with a non-permeable pool cover	Allowed where features are operated by recycling water	Not allowed	105	
Level 4	Not allowed	Allowed after seven days	Twice per week (Tuesday & Saturday) for one hour before 9H00 and after 16H00	Compulsory	Allowed	Not allowed	Not allowed	Not allowed	100 Litres	Yes
Level 5	Not allowed	Allowed after seven days	Twice per week (Tuesday & Saturday) for one hour before 9H00 and after 16H00	Compulsory	Allowed	Not allowed, even with a non-permeable pool cover	Not allowed	Not allowed	87Litres	Yes
Level 6A	Not allowed	Allowed after seven days	Twice per week (Tuesday & Saturday) for one hour before 9H00 and after 16H00	Compulsory	Allowed	Not allowed, even with a non-permeable pool cover	Not allowed	Not allowed	87 Litres	Yes
Level 6B	Not allowed	Allowed after seven days	Twice per week (Tuesday & Saturday) for one hour before 9H00 and after 16H00	Compulsory	Allowed	Not allowed, even with a non-permeable pool cover	Not allowed	Not allowed	50 Litres	Yes

Appendix F2: Price regime for water restrictions for educational institutions

Water restriction level	Price per Kilolitre (R)*					
	2016/17[1]	2017/18[1]	%increase	2017/2018[2]	2018/2019[2]	%increase
Level 1	16.58	19.78	19.25	19.55	26.20	31.31
Level 2	19.29	21.76	12.78	21.95	27.30	24.38
Level 3	22.41	23.74	5.93	23.94	28.82	20.36
Level 4	NA	**24.72**	NA	24.94	33.14	32.88
Level 5	NA	NA	NA	43.13	43.13	0.00
Level 6	NA	NA	NA	**57.50**	52.61	-8.50
Level 7	NA	NA	NA	86.25	60.63	-19.16

The blue highlighted cells are the price increase as reported by Fell & Winter (2018)

***The price regime in Appendix F2 applies to only the CoCT. Other municipalities and provinces have different price regime. The price regime depends on the time of year the water restrictions are implemented.

[1] http://resource.capetown.gov.za/documentcentre/Documents/Financial%20documents/Budget%202017-2018%20Annexure%206%20combined.pdf

[2] http://resource.capetown.gov.za/documentcentre/Documents/Financial%20documents/Budget%202018-2019%20Annexure%206%20Tariff%20Fees%20and%20Charges%20Book.pdf