INVESTIGATING THE ANTECEDENTS TO TEACHING GREEN INFORMATION TECHNOLOGY (GREEN IT): A SURVEY OF STUDENT TEACHERS IN SWAZILAND

by

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Declaration Statement

I declare that "Investigating the Antecedents to Teaching Green Information Technology (Green IT): A Survey of Student Teachers in Swaziland" is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the thesis/dissertation to originality checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

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Abstract

The natural environment is important for human existence and the ubiquity of Information Technology (IT) has negatively impacted on the natural environment. Green IT offers to address these negative effects. However, since Green IT practices are often not common knowledge, it is vital that they are taught to others. Teachers typically have the skills and opportunities to teach many people. The research problem was the lack of research focusing on the teaching of Green IT in the context of the urgent need for it and teachers' limited knowledge and competencies relating to Green IT. The study employed a survey research strategy, involving exploratory factor analysis, ANOVA and structural equation modeling (SEM). The main findings indicate that allocating time and resources to improve student teachers' level of awareness, perceived behavioural control and person-related beliefs would positively influence their intention to teach Green IT, and, in turn, their Green IT teaching.

Die natuurlike omgewing, wat so noodsaaklik is vir menslike voortbestaan, word negatief beïnvloed deur die alomteenwoordigheid van inligtingstegnologie. Groen IT-praktyke kan gebruik word om sodanige negatiewe effekte in te perk, maar aangesien die nodige kennis nie alombekend is nie, moet dit aan ander oorgedra word. Onderwysers het beide die vaardighede en die geleenthede om inligting aan groot groepe mense oor te dra. In dié geval was die navorsingsprobleem 'n gebrek aan studies wat fokus op die dringende noodsaaklikheid van Groen IT-onderrig, asook onderwysers se beperkte verwante kennis en vaardighede. 'n Opname is gebruik as navorsingstrategie, met eksploratiewe faktorontleding, variansie-ontleding (ANOVA) en strukturele vergelykingsmodellering (SVM). Ingevolge die hoofbevindinge sal die beskikbaarmaak van tyd en hulpbronne leerlingonderwysers se bewuswordingsvlakke verbeter, sowel as hul waarneembare gedragswetenskaplike beheer en hul persoonsverwante beskouinge, en 'n positiewe uitwerking hê op hul voorneme om Groen IT te onderrig, wat weer op sy beurt hul Groen IT-onderrig sal bevoordeel.

Imvelo yemvelo ibalulekile ekubeni khona komuntu nokutholakala kobuchwepheshe bezokwazisa kuye kwaba nomthelela omubi emvelweni yemvelo. Ubuchwepheshe bezokwazisa obuluhlaza bunikeza izindlela zokubhekana nemiphumela emibi. Kodwa-ke, njengoba imikhuba yobuchwepheshe bezokwazisa obuluhlaza ayivamile ukuba ulwazi

oluvamile, kubalulekile ukuthi ifundiswe kwabanye. Othisha sidalo sabo banawo amakhono namathuba ukufundisa abantu abaningi. Inkinga yocwaningo ukuntuleka kocwaningo okugxila ekufundiseni kobuchwepheshe bezokwazisa obuluhlaza esimweni sesidingo esiphuthumayo sabo, nolwazi olulinganiselwe lothisha kanye namakhono afanelekayo kubuchwepheshe bezokwazisa obuluhlaza. Isu lokucwaninga ucwaningo lwasetshenziswa, okubandakanya ukuhlaziywa kwesici sokuhlola, ANOVA kanye nokuhlelwa kwesifaniselo esiyisilinganiso (SEM). Ukutholwa okusemqoka kubonisa ukuthi ukwabela isikhathi kanye nezinsiza zokuthuthukisa abafundi othisha izinga lokuqwashisa, ukulawula kokuziphatha okubonwayo kanye nezinkolelo ezihlobene nomuntu zizoshukumisa kahle izinhloso zabo ukufundisa ubuchwepheshe bezokwazisa obuluhlaza futhi nemfundiso yabo yobuchwepheshe bezokwazisa obuluhlaza.

Keywords (in alphabetical order):
Green computing, Green Information Technology (Green IT), Green Information Systems (Green IS), education and teaching, environmental sustainability, structural equation modeling (SEM), student teachers, theory of reasoned action (TRA), theory of planned behaviour (TPB).

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List of Academic Outputs Based on this Research

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List of Prominent Abbreviations

- ANOVA Analysis of variance
- EFA: Exploratory factor analysis
- Green IS: Green Information Systems
- Green IT: Green Information Technology
- ICT: Information and communications technology
- IS: Information Systems
- IT: Information Technology
- lavaan: latent variable analysis software
- SEM: Structural Equation Modeling
- SPSS: Statistical Package for the Social Sciences

Glossary of key terms

- Electronic waste: "Consists of electronic products that have been retired from use" (Ahmed, 2008, p. 2).
- Environmental sustainability: "Sensible use of our huge (but finite) natural resources, so that they are not dissipated negligently, thus degrading the quality of life for future generations" (Andrews, 2009, p. 359).
- Green computing: "Refers to the efficient use of resources in computing in conjunction with minimising environmental impact, and maximising economic viability" (Khan, Kołodziej, Li, & Zomaya, 2013, p. 2).
- Greenhouse gas (GHG): "Any gas that has the property of absorbing infrared radiation (net heat energy) emitted from Earth's surface and reradiating it back to Earth's surface, thus contributing to the phenomenon known as the greenhouse effect. Carbon dioxide, methane, and water vapour are the most important greenhouse gases" (Encyclopedia Britannica, 2017). Carbon dioxide (CO_2), specifically, is an important greenhouse gas since it contributes significantly to the greenhouse effect, which causes global warming, and its level in the atmosphere has been increased by human activities (Watson, 2009).

- Green ICT: “The study and practice of using computers and telecommunications in a way which maximises positive environmental benefit and minimises negative impact” (Worthington, 2009, p. 16).

- Green IS: “Green IS includes Green IT, which focuses primarily on environmental sustainability throughout the IT lifecycle, and Green IS aim to enable and transform entire organisations toward environmental sustainability” (Howard & Lubbe, 2012, p. 306). In order to address the research problem sufficiently, this study focuses on the Green IT aspect of Green IS.

- Green IT: “The study and practice of designing, manufacturing, using, and disposing of computers, servers, and associated subsystems - such as monitors, printers, storage devices, and networking and communication systems- efficiently and effectively with minimal or no impact on the environment” (Murugesan, 2008, pp. 25-26). Based on the definitions provided in this section, the concepts of Green ICT, Green computing and sustainable IT are regarded as conceptually equivalent to the concept of Green IT. Thus, the term Green IT is used in this study, but it appropriately refers to all of these concepts.

- Information and communications technology (ICT): “Information and communications technology (ICT) refers to all the technology used to handle telecommunications, broadcast media, intelligent building management systems, audio-visual processing and transmission systems, and network-based control and monitoring functions” (Technopedia, 2016).

- Information technology (IT): “Includes all tools that capture, store, process, exchange, and use information. The field of IT includes computer hardware, such as mainframe computers, servers, laptops, and PDAs; software, such as operation systems and applications for performing various functions; networks and related equipment, such as modems, routers, and switches; and databases for storing important data” (Reynolds, 2009, p. 4).

- Sustainability: “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987, p. 43).

- Sustainable IT: “The design, production, operation, and disposal of IT and IT-enabled products and services in a manner that is not harmful and may be positively beneficial to the environment during the course of its whole-of-life” (Topi & Tucker, 2014, pp. 50-51).

Chapter 1: Introduction to the Research

1.1 Chapter introduction

This study investigates the antecedents to teaching Green Information Technology (Green IT). The study focuses on student teachers in an African country, namely Swaziland. The goal of Chapter One is to provide a foundation for the research. In order to achieve the goal of the chapter, the chapter has the following objectives: to provide context for the research, to formulate the problem statement, research objective and research questions and to provide a summary of the research design.

Chapter One continues by providing the background and context of the study. Thereafter, the problem definition, research objective and research design summary are presented. Then the scope, assumptions and delimitations are discussed, and the overall layout of the dissertation is provided. The chapter ends with a chapter summary and conclusions.

1.2 Background and context

The natural environment is important because human life relies on it for existence (Melville, 2010). However, the natural environment is rapidly degrading (Elliot & Webster, 2017; Melville, 2010). The degrading of the environment has been considered life-threatening because it affects the whole world (Elliot & Webster, 2017). Efforts made to improve the environment are out-paced by current levels of gas emissions (Elliot & Webster, 2017). Internationally, environmental sustainability has become a priority as a way to protect the environment (Chou & Chou, 2012).

In relation to addressing environmental degradation, the term "Green" refers to any endeavour that helps to protect the environment (Heskett, 2010; Miller, 2010). Thus, Green Information Technology (Green IT) involves information technology (IT) and environmental sustainability (Chou & Chou, 2012), and addresses environmental damage and degradation (Ahmad, Bello, & Nordin, 2013; Birchi, 2015; Miller, 2010; Murugesan, 2008). Notably, based on the definitions provided in the glossary of key terms section, the concepts of Green ICT, Green computing and sustainable IT are regarded as conceptually equivalent to the concept of Green IT. Thus, the term Green IT is used in this study, but it appropriately refers to all of these concepts.

The important goals of Green IT are the reduction of carbon dioxide emissions, which contribute to climate change and global warming and the reduction of electronic waste (e-waste) (Dookhitram, Narsoo, Sunhaloo, Sukhoo, & Soobron, 2012; Murugesan, 2008), which

contains hazardous substances like selenium and cadmium (Ansari, Ashraf, Malik, & Grunfeld, 2010).

In response to the degradation of the environment, many regions have made various plans to tackle the environmental issues (Elliot & Webster, 2017). Furthermore, various governments, industries and tertiary education institutions have come up with different Green IT initiatives, policies and approaches (Phyper & MacLean, 2009). For example, some governmental agencies have implemented standards and regulations that encourage Green IT (e-Cylcle, 2013). In industry, Green IT initiatives such as the climate savers computing initiative (CSCI), electronic product environmental assessment tool (E-PEAT), Green grid, Green500 and Green Communication Challenge have been established to promote Green IT (Speshock, 2010; Smith, 2013; Prasad, 2010; Unhelkar, 2010; Webber & Wallace, 2009). In addition, an example of a tertiary education institution's approach is the University of Hertfordshire, which developed a Green IT strategic plan (Hertfordshire University, 2016).

1.3 Problem definition, research questions and research objective

The literature reveals that IT contributes to environmental degradation, which threatens the well-being of people (Kelly & Adolph, 2008; Unhelkar, 2010). This occurs during the IT lifecycle, which involves production, usage and disposal, and results in harmful carbon emissions and e-waste (Kelly & Adolph, 2008; Murugesan, 2008). Researchers have indicated that IT is responsible for 2.5% to 3% of global carbon emissions (Bandi, Bose, & Saxena, 2015; Murugesan & Laplante, 2011; Boccaletti & Moro, 2000), which contribute to global warming (Kok, 2002; Elliot, 2007; Kelly & Adolph, 2008; Wang, Vasilakos, Chen, Liu, & Kwon, 2012). Moreover, IT now has a similar carbon footprint to air transportation (Mishra, Akman, & Mishra, 2014). Thus, the concept of Green IT has emerged to addresses the negative effects of IT on the environment (Chow & Chen, 2009).

In particular, Student teachers are viewed as essential agents for imparting and instilling Green IT knowledge and behaviour into future generations, because student teachers are deemed to have a significant influence on the behaviour of the many pupils they may teach throughout their teaching careers (Kaur & Kaur, 2013). However, the literature demonstrates that student teachers have limited knowledge and competencies relating to the many aspects of environmental sustainability (Boubonari, Markos, & Kevrekidis, 2013; Burmeister & Eilks, 2013; Evans, Whitehouse, & Hickey, 2012; Esa, 2010; Özden, 2008). In addition, the teaching of environmental education in schools is considered inconsistent due to a lack of knowledge and a poor commitment to teaching about environmental matters (Liang, Liu, & Fulmer, 2016).

Furthermore, the literature reports that student-teacher training with regards to education for sustainability is ad-hoc globally (Boon & Wilson, 2011). Few teacher-training institutions have incorporated sustainability education into student-teacher training courses (Beckford, 2008). For instance, environmental sustainability was not properly covered in teachers' training courses in Spain (Sureda-Negre, Oliver-Trobat, Catalan-Fernández, & Comas-Forgas, 2014). In addition, it appears that a shortage of sustainability courses in tertiary education has caused a shortage of student teachers with adequate knowledge of environmental and sustainability education (Evans et al., 2012). It is recommended that teacher-training institutions should offer courses to help student teachers boost their environmental sustainability insight and knowledge (Boon & Wilson, 2011) and extra training for environmental sustainability knowledge and awareness be mandatory for student teachers in third world countries (Özden, 2008). It has also been found that teachers have not had time to teach sustainability because they concentrated on their major subjects and their time tables did not allow enough time to fit sustainability into their curriculums (Redman, 2013; Wheeler & Bryne, 2003). Similarly, it has been discovered that teachers have had a high workload, and, as a result, sustainability teaching was not incorporated into teaching curriculums (Wu, 2002) and integrating sustainability education into schools was very difficult where teachers did not receive the needed support from their school administration (Redman, 2013). These aspects are elaborated on in Section 2.4.2. Thus, research focusing on Green IT and student teachers is important for environmental sustainability and minimising IT-related environmental depletion and degradation.

In addition, a literature search was conducted in August 2016 for relevant, contemporary Green IT articles published since 2010, which was regarded as a reasonable starting date for obtaining contemporary IT research. The search resulted in just over 50 articles. These are provided in Appendix A. Of these articles, only 18 involved students of various types. Out of the 18 articles, only one involved education faculty students, amongst other students, and did not address teaching of Green IT. Importantly, none of the articles addressed the theoretical antecedents or behavioural drivers of teaching Green IT, which are considered vital for understanding how to improve student teachers' intention to teach Green IT and, subsequently, their actual behaviour of teaching Green IT.

Hence, the research problem is the lack of research focusing on the teaching of Green IT. This is in the context of the urgent need for this and of teachers' limited knowledge and competencies relating to the many aspects of environmental sustainability, including Green IT. Therefore, addressing this research problem presents an original contribution to the academic body of knowledge In addition, this research problem and addressing it also has

value for teaching practice by informing any future teaching and curriculum design in teacher-training institutions that involve Green IT. Specifically, it provides curriculum guidance for promoting Green IT and environmental sustainability in general.

Furthermore, out of the articles in Appendix A, only four involved participants from African countries. This shows the need for further sustainability research in Africa because Africa is a continent that is especially vulnerable to global warming and environmental degradation (Low, 2006). Accordingly, the study's research questions are:

1) What are the antecedent factors influencing the teaching of Green IT?
2) Which factors are the most significant in the teaching of Green IT?
3) What guidelines and recommendations can be made to college management to improve the teaching of Green IT?

To answer these questions, the study's research objective is to investigate the antecedents to teaching Green IT in an African country context, in order to understand how to improve student teachers' intention to teach Green IT and consequently their actual behaviour of teaching Green IT.

1.4 Research design summary

The study uses a quantitative research design that employs structural equation modelling (SEM) to analyse the data. Quantitative research designs are important because they enable the measurement and explanation of phenomena and aim for objectivity by using numbers and statistics (McMillan & Schumacher, 2006). In addition, quantitative research is suitable for testing and validating theories and hypotheses and may generalise findings (Ellis & Bond, 2016; Johson & Christensen, 2010). A closed-ended questionnaire was used to collect data from participants, who were student teachers. Closed-ended questionnaires are used because they provide response uniformity and efficient data analysis (Rubin & Babbie, 2009).

1.5 Scope and limitations

The study focuses on student teachers in three teacher-training institutions in the African country of Swaziland. The study did not cover all student teachers in all teacher-training institution/s in Swaziland due to access constraints. Nevertheless, the practicable institutions provide enough data to address the research problem.

Notably, Green IT practices are often not common sense and so it is necessary that Green IT practices are taught to others. Teachers, typically, have the skills and opportunities to influence the behaviour of the many pupils they teach throughout their teaching careers and student teachers, in particular, are viewed as essential agents for imparting Green IT knowledge and instilling Green IT behaviour into future generations since they have their

entire teaching careers ahead of them and should understand contemporary IT and related issues.

The criteria used for selecting respondents are student teachers from teacher-training institutions in the African country of Swaziland, covering all education teaching grade ranges and qualification types and exhibiting a wide range of demographic characteristics. Specifically, the sample consists of student teachers from three teacher training institutions in Swaziland, the teaching grade ranges of early childhood, primary and secondary education and the qualification types of diplomas and bachelor's degree. Thus, the sample is representative of the main categories of student teachers to which the research problem relates.

1.6 Layout of the dissertation

The dissertation consists of five chapters. Chapter One provides the introduction and background to the study. In addition, Chapter One provides the problem definition, objective and research design summary, as well as the scope and limitations of the study. Chapter Two is a review of the relevant literature including the theories, frameworks and models that are used in the Green IT field to answer research question one. Chapter Three describes the methodology, research strategy and sampling techniques. This chapter also discusses how the data are analysed and ethical considerations. Chapter Four presents and discusses the data. The chapter also discusses the findings and hypotheses based on the data analysis to answer research question two. Chapter Five is the final chapter, which begins by providing a summary of the data presentation and then proceeds to demonstrate how the research problem statement was addressed. Thereafter, recommendations are presented for improving student teachers' intention to teach Green IT and consequently their actual behaviour of teaching Green IT, which answers research question three. In addition, the study's limitations and future research avenues are discussed.

1.7 Chapter summary and conclusions

Chapter One explained that although IT contributes to environmental depletion and degradation, it also has the ability to mitigate environmental depletion and degradation, in the form of Green IT. In addition, Chapter One explained that research focusing on Green IT and student teachers is important for environmental sustainability and minimising IT-related environmental depletion and degradation.

Chapter One achieved its objectives, which were to provide background information and context for the research, formulate the problem statement, research objective and research questions and provide a summary of the research design. Thus, Chapter One achieved its goal,

which was to provide a foundation for the research. In addition, the chapter provided the study's scope, assumptions and delimitations, layout of the proposal and definitions of key terms.

In conclusion, Chapter One supports the claim that Green IT is essential for minimising environmental depletion and degradation. The chapter also substantiates the requirement for further Green IT research that focuses on student teachers and student teachers in an Africa country context. Thus, it is necessary to acquire knowledge about the antecedents to teaching Green IT in order to inform theory and improve student teachers' intention to teach Green IT and consequently their actual behaviour of teaching Green IT.

This chapter has value for academics since it exposes the necessity to investigate the antecedents to teaching Green IT. This chapter also has value for teaching practice by demonstrating the necessity for incorporating Green IT into teaching.

The next chapter is Chapter Two, which presents the literature review, being a comprehensive synthesis of past research relating to Green IT. The literature contextualises the proposed study within past research and provides further justification for the stated research problem. In addition, Chapter Two discusses, analyses and synthesises relevant theoretical frameworks and models for guiding the study and for specifying the research hypotheses.

Chapter 2: Literature Review

2.1 Chapter introduction

The previous chapter, Chapter One, provided the foundation for the research. Chapter Two follows with a review of relevant literature. The goal of the literature review is to analyse and synthesise past research studies that relate to Green IT and present an appropriate research model for analysing the behavioural drivers of teaching Green IT, to answer research question one. In order to achieve this goal, Chapter Two has the following objectives: explaining the literature review process to demonstrate a rigorous literature review, uncovering key theories, models, frameworks and phenomena in the domain, clarifying the contribution of the research, developing an appropriate research model and specifying the research hypotheses.

Chapter Two proceeds by detailing the literature review process, the literature search process and the literature analysis and synthesis process, which involves the development of a literature concept matrix. Thereafter, the relevant themes synthesised from the literature, aided by the literature matrix, are discussed. These themes are: environmental sustainability and related concepts; student teachers, teachers and sustainability; Green IT; students' awareness of and attitudes and intentions toward Green IT and applicable theories, frameworks and models. The final section of the chapter is the summary and conclusions section.

2.2 Literature review process

2.2.1 Keywords, databases and search engines

In searching for literature, keywords relating to the research problem were used. These include pre-service teacher, Green computing, Green Information Technology, Green teacher training, Green Information Technology principles, Green Information Technology awareness, Green Information Technology education and various combinations and derivatives of these. These keywords were applied to Google Scholar and the University of South Africa's (UNISA's) library and electronic academic databases.

2.2.2 Search strategy

Searching for literature began with the Google Scholar search engine using the aforementioned keywords. Thereafter, backward and forward searches were conducted in order to obtain additional relevant literature. Backward searching relates to searching through the references of relevant articles and books (Levy & Ellis, 2006; Wester & Watson, 2002) and can involve three approaches, namely, reference searches, author searches and keyword

searches (Levy & Ellis, 2006). In contrast, forward searching relates to searching for articles that have cited a relevant article (Levy & Ellis, 2006).

2.2.3 Assessing the quality of the literature

The literature used consisted of peer-reviewed academic articles, academic books and certain recommended websites. In addition, many of the articles and books used in the literature review were recent publications. However, less recent articles and books were used based on their relevance and conceptual applicability. In addition, journal articles were accessed through the UNISA's library and electronic academic databases to ensure that only peer-reviewed articles were used.

2.3 Literature analysis process-the concept-centric literature matrix

A concept-centric literature matrix is useful for analysing concepts or themes evident in the literature relating to the research problem (Lubbe & Klopper, 2012). Thus, the literature review of the study was developed using a concept-centric literature matrix. The first column of the matrix contains citations of all the articles retained from the literature search process. The headings of the columns are the relevant concepts or themes that were evident in the literature. The literature matrix assisted the researcher to analyse, categorise and synthesise the large volume of articles (Lubbe & Klopper, 2012; Webster & Watson, 2002).

The applicable concept-centric literature matrix is provided in Appendix B. The headings of the sub-sections in the following literature review, Section 2.4 below, were obtained from the column headings of the literature matrix, namely, environmental sustainability and related concepts; student teachers, teachers and sustainability; Green IT; students' awareness of and attitudes and intentions toward Green IT and applicable theories, frameworks and models.

2.4 Literature review

2.4.1 Environmental sustainability and related concepts

A useful starting point is the frequently mentioned term 'sustainable development', which comprises environmental sustainability in addition to two other aspects or pillars, namely, economic and social aspects (Moldan, Janoušková, & Hák, 2012). Thus, environmental sustainability is one pillar of sustainable development (Moldan et al., 2012). According to the World Commission on Environment and Development (WCED) (WCED, 1987), also known as the Brundtland Commission, sustainable development is about development that fulfils the needs of the present generation without preventing future generations from meeting their own needs. Nevertheless, the concept of sustainable development has been approached and understood in many different ways (Holden, Linnerud, & Banister, 2014). As a result, it has

been difficult for sustainable development to guide policymaking (Holden et al., 2014). Some scholars have even argued that the concept of sustainable development may be in danger of becoming less relevant (Hopwood, Mellor, & O'Brien, 2005; Redclift, 2005).

However, environmental sustainability as a concept remains highly relevant. Specifically, environmental sustainability is concerned with maintaining and taking care of environmental resources and ecosystems (Hostovský, 2014) which include the air, soil and water (Sands, 1995). Environmental sustainability addresses the problem of environmental degradation and depletion by requiring maintenance of the environment so that it can support the current generation and future generations (Howard & Lubbe, 2012). Factors such as overpopulation, increased economic growth and pollution are major drivers of environmental degradation and depletion (Huesemann & Huesemann, 2011).

It is important that the biosphere, which is the layer that embraces the earth and sustains all life, is able to provide society with sufficient natural goods and services of adequate quality in the long run for human survival and well-being (OECD, 2001). Natural goods and services include energy, materials, space and biodiversity. Four specific criteria for environmental sustainability are regeneration, substitution, assimilation and irreversibility avoidance (OECD, 2001).

In support of environmental sustainability, many organisations and individuals have embraced the idea of going Green, which is a general term involving many different approaches to protecting the environment (Heskett, 2010; Miller, 2010; White, 2013; Kocsis, 2010). For example, the Green concept has been used to denote using less energy, recycling materials, reducing waste and preventing pollution (Molla, Cooper, & Pittayachawan, 2011). Green can also refer to eco-friendly practices and behaviours (Gay, 2012). Thus, the concept of 'Green' is important because it is aligned with environmental sustainability.

2.4.2 Student teachers, teachers and sustainability

The concepts explained in Section 2.4.1 are relevant for student teachers as they become teachers who disseminate information to many pupils (Karpudewan, Ismail, & Mohamed, 2013) whose lives are impacted by environmental degradation and depletion. However, research has shown that many student teachers have shallow knowledge and comprehension of concepts related to environmental sustainability (Karpudewan et al., 2013; Wu, 2002). For example, science student teachers have had difficulty in explaining the term sustainable development and student teachers' knowledge of sustainability has been found to be inadequate (Chou & Chou, 2012). Furthermore, it has been found that educators and student teachers misunderstand numerous environmental issues (Boubonari, Markos, & Kevrekidis,

2013). For example, it was found that student teachers have misconceptions regarding the terms ‘greenhouse gas’ (GHG) and ‘ozone layer depletion’ (Çakır, İrez, & Doğan, 2010). In addition, it has been argued that the intense lack of knowledge about environmental issues among the overall population and among Information and Communications Technology (ICT) students is one of the problems that faces ICT education (Tedre, Chachage, & Faida, 2009). Indeed, there is evidence that teachers need to acquire sustainability knowledge for them to be better equipped to disseminate that knowledge to their pupils (Wheeler & Bryne, 2003).

It has also been found that while some student teachers were confident in their abilities to teach sustainability, they were unaware of how little they knew about environmental sustainability (Effeney & Davis, 2013). Similarly, it was evident that while certain student teachers had positive attitudes toward sustainability education and were even willing to teach education for sustainability in chemistry education, their sustainability knowledge was not theoretically correct (Burmeister & Eilks, 2013). In addition, research revealed that particular Malaysian secondary school biology student teachers had sufficient knowledge of numerous environmental concepts, but their behaviour towards the environment was not good (Esa, 2010).

It seems that student teacher-training with regards to education for sustainability is ad-hoc globally (Boon & Wilson, 2011). Few teacher-training institutions have incorporated sustainability education into student-teacher training courses (Beckford, 2008). Research indicates that environmental sustainability was not properly covered in teachers’ training courses in Spain (Sureda-Negre, Oliver-Trobat, Catalan-Fernández, & Comas-Forgas, 2014).

Other research indicates that there are insufficient environmental skills amongst student teachers (Álvarez-García, Sureda-Negre, & Comas-Forgas, 2015). Moreover, it appears that a shortage of sustainability courses in tertiary education has caused a shortage of student teachers with adequate knowledge of environmental and sustainability education (Evans et al., 2012). This may be due to education for sustainability being a relatively new concept (Boon & Wilson, 2011). Teacher-training institutions should offer courses to help student teachers boost their environmental sustainability insight and knowledge (Boon & Wilson, 2011). It has also been suggested that extra training for environmental sustainability knowledge and awareness be mandatory for student teachers in third world countries (Özden, 2008).

Notably, education for sustainability has faced many challenges in schools. It has been found that teachers have not had time to teach sustainability because they concentrated on their major subjects that are examined and their time tables did not allow enough time to fit sustainability into their curriculums (Redman, 2013; Wheeler & Bryne, 2003). Similarly, it has been discovered that teachers have had a high workload, and, as a result, sustainability

teaching was not incorporated into teaching curriculums (Wu, 2002). Some teachers have even felt threatened by the prospect of teaching this subject (Redman, 2013), and integrating sustainability education into schools was very difficult where teachers did not receive the needed support from their school administration (Redman, 2013).

In addition, research has been conducted about student teachers' motivation to teach sustainability. For example, research was conducted focusing on student teachers' views about teaching sustainability (Mutherbaugh & Kern, 2012). At first, the student teachers did not see the relevance of teaching sustainability in schools, but after being involved in creating an integrated lesson, they changed their perceptions about sustainability and showed willingness to incorporate sustainability into their individual subjects because they realised its importance (Mutherbaugh & Kern, 2012).

The literature also demonstrates that there have been student teachers that were positive about teaching sustainability and have successfully gained sustainability knowledge. For example, a study found that more than 50% of student teachers were positive about teaching sustainability because they saw sustainability as an important concept and had a sustainability vocabulary (Tomas & Mills, 2011). In addition, research was reported about student teachers who enrolled in a sustainability course (Tal, 2010), and in the beginning of the course their knowledge about the environment was limited. However, by the end of the course their knowledge about the environment improved. The improvement was attributed to the different teaching methods, online debates and field trips (Tal, 2010). Additionally, a study reported that after being exposed to a sustainability programme, student teachers' knowledge and awareness about the environment increased and they developed good attitudes towards the environment (Candan & Erten, 2015). Furthermore, behaviour, in addition to knowledge and attitude, should always be considered for achieving environmental sustainability (Erten & Aydoğdu, 2011).

In summary, the literature demonstrates that many student teachers and teachers lack environmental sustainability knowledge with only a few studies reporting sufficient knowledge. The literature also exposes the need to foster good attitudes and motivation towards environmental sustainability. Thus, the development of knowledge, positive attitudes, awareness and motivation relating to the environment is deemed necessary for behaviour that supports environmental sustainability.

2.4.3 Green IT

There are several terms that are frequently used in the domain, these are Green computing, Green IT, Green ICT, environmentally sustainable computing and even IT for sustainability

(Li & Zhou, 2011; Bandi, 2015; Ramachandiran, 2012; Zhang & Liang, 2012; Gupta, 2010; Phunde, Godbole, & Sapa, 2014). Based on the definitions provided in Section 1.2, all of these concepts and their comparable variations are regarded as conceptually equivalent to the concept of Green IT. Thus, the term Green IT is used in this study, but it appropriately refers to all of these concepts. To reiterate, Green IT is a concept involving energy consumption and electronic waste minimisation throughout the IT lifecycle, which involves IT design, production, use, and disposal (Murugesan, 2008). In addition, Green IT has been described as a field of study that concerns producing and designing IT equipment with the lowest possible impact on the environment (Murugesan, 2008). An important aspect of Green IT is the management of carbon dioxide emissions, which is a by-product of IT energy consumption (Samuri, 2014).

From an historical perspective, there is consensus among scholars that Green IT has its beginnings in the Energy Star program in 1992 (Gupta, 2010; Selyamani & Ahmad, 2015). The Energy Star program was set up by the United States (US) Environmental Protection Agency (EPA). The EPA established the Energy Star program to reduce energy consumption and decrease GHG emissions (Selyamani & Ahmad, 2015). Similar initiatives were the Swedish Tjänstemännens Central Organisation (TCO), which set up a TCO program to advance low magnetic and electrical emissions from cathode ray tube (CRT) displays (Gupta, 2010), and the China Energy Conservation Program (CECP), founded in 1998 by the China National Development and Reform Commission (NDRC) (Venkat, Rao, Rani, Swetha, & Satyam, 2015). The CECP was concerned with the administration, management and awarding of energy certification for environmentally friendly products. The mandate of all these organisations was to ensure that a healthy environment is maintained alongside advancement in technology.

During this time, the term ‘Green computing’ became prominent, being concerned with the energy-efficiency of electronic devices, such as computers (Kimppa, Whitehouse, Kuusela, & Phahlamohlaka, 2014). However, by 2007, the term sustainable ICT was more common (Kimppa et al., 2014), and thereafter, the term Green Information Technology (Green IT) became prevalent. Green IT promoted increased energy efficiency, decreased power utilisation, reduced carbon foot print, reduced e-waste and reduced global warming (Ahmaro, Bin Mohd Yusoff, & Abualkishik, 2014). Nevertheless, some researchers have indicated that the benefits of Green IT are mainly cost and energy savings (Tushi, 2015; Brooks, Wang, & Sarker 2012; Murugesan, 2008). Indeed, it is reported that companies that have implemented Green IT initiatives have had the additional advantages of competitive edge, support from

investors and users and less government tax (Saha, 2014). Thus, the benefits of Green IT can be classified as financial, environmental, customer and tax benefits (Gupta, 2010).

Several approaches to or strategies for Green IT have been reported (Ahmaro et al., 2014; Batlegang, 2012; Bezáková, 2013; Gupta, 2010; Jena, 2010; Mogotlhwane, 2014; Murugesan, 2008; Venkat et al., 2015). These include making use of Green computers, laptops and servers, virtualization, using Green data storage, using Green software, refurbishing and donating old computers, using thin client-computers, using power management on computers, switching off computers when not in use, telecommuting, algorithmic efficiency, making using of cloud computing and using Green applications such as Blackle.

In addition, it is evident that Green IT strategies vary amongst countries; for instance, in Malaysia the main strategies are telecommuting, algorithmic efficiency and voice over internet protocol (VOIP) (Ahmaro et al., 2014). Other countries, such as Korea, enforce Green government policies in industries and organisations, requiring the implementation and use of Green IT technologies (Ansari et al., 2010). Despite these varied approaches to or strategies for Green IT, it is noted that the relevant Green IT stakeholders themselves had different levels of knowledge about Green IT, which created Green IT strategy implementation difficulties (Murugesan & Laplante, 2011).

In relation to the study's research problem, the literature emphasises that students, generally, should be taught about Green IT so that they can become leaders of a sustainable future (Roodt & de Villiers, 2012) through the design and implementation of Green IT strategies. However, the current state of Green IT practice, not teaching, by students is inconclusive. For example, one study found that the majority of the students participating, about 60%, did practice Green IT in some form, such as power management, e-mail, Green web search tools and learning through the internet (Ramachandiran, 2012), while a different study found that students' everyday Green IT behaviours were not good despite the fact that their level of Green IT knowledge was average (Selyamani & Ahmad, 2015).

2.4.4 Students' awareness of and attitudes and intentions toward Green IT

Sub-section 2.4.2 expressed the importance of environmental sustainability awareness. Generally, awareness refers to having knowledge or showing perception of a fact, situation or phenomenon (Abbate, 2015). In the context of this study, awareness refers to having knowledge about Green IT. The literature shows that students have a general lack of Green IT awareness. For example, a Malaysian study found that the majority of the participating students did not know about or were unaware of the available Green IT technologies (Ahmad et al., 2013). However, it was pointed out that the students had the ability to utilise IT to support environmental sustainability when given the necessary training. Another study found

that tertiary institution students were mostly unconcerned about and unaware of the harmful effects of IT and the benefits of Green IT (Batlegang, 2012). Similarly, only 18% of students in a technology university in Mauritius were aware of energy saving when using computers (Dookhitram et al., 2012).

In another study in Malaysia, it was found that the level of Green IT awareness and knowledge of polytechnic tertiary education institution students was obscure (Samuri, 2014). It was also discovered that the concept of Green IT was exceptionally new to certain students (Ansari et al., 2010). These students were not even aware of Green IT basics, such as the disposal of mobile handsets and batteries. This lack of awareness of Green IT resulted in poor e-waste management. In another study, students were found to have no awareness of concepts such as carbon foot print, E-PEAT, Green IT and e-waste (Ahmad, Nordin, & Bello, 2013). In addition, the study revealed that about 60% of the students regarded themselves as not knowledgeable about Green IT. However, the level of Green IT awareness amongst students who were majoring in computer-related courses was found to be fair (Dookhitram et al., 2012).

In addition, the literature has indicated that the Green IT awareness of tertiary institution students affects their intention to embrace Green IT (Seitz, Yanti, & Karant, 2010). Similarly, students' intention to adopt Green IT is significantly influenced by their awareness (Birchi, 2015). In other words, those who have the relevant Green information tend to deal with the environment positively and are conscious of environmental impacts (Jenkin, Webster, & McShane, 2011). Thus, awareness has a pivotal part to play in people's environmental conduct or behaviour (Amel, Manning, & Scott, 2009).

It has also been demonstrated that an individual's level of Green IT awareness has an impact on that individual's attitude towards Green IT (Mishra, Akman, & Mishra, 2014). Attitudes toward Green IT have been found to relate to intention to practice Green IT (Hanks, Odom, Roedl, & Blevis, 2008). Thus, attitude also plays an important role in behaviour change (Newhouse, 1990). Moreover, a person's environmental attitude portrays that person's sentiments with respect to the environment (Hines, Hungerford & Tomera, 1986). Attitudes may be directed to objects, specific issues and action (Ajzen & Fishbein, 1980). It has been argued that the principal variable determining the intent of computing consumers to exercise Green IT is their attitude towards Green IT (Chow & Chen, 2009).

Green IT attitudes have also been measured and it was found that that there is a clear pattern where respondents with favourable attitudes engaged in more Green IT practices (Molla, Abareshi, & Cooper, 2014), and influence an individual's intention to exercise Green IT (Chen, Shi, & Chow, 2015; Chiyangwa, 2014).

2.4.5 Applicable theories, frameworks and models

2.4.5.1 Introduction

Theories are valuable for explaining why things happen (Gratton & Jones, 2004). A theory is important for research because it influences what is observed and how the results are interpreted (Babbie, 2007). The objective of the research, as presented in Section 1.4, is to investigate the antecedents to teaching Green IT in an African country context, in order to understand how to improve student teachers' intention to teach Green IT and consequently their actual behaviour of teaching Green IT. Corresponding to this objective, the relevant literature presented six prominent and applicable theories, frameworks and models. The following sub-sections analyse these theories, frameworks and models for the purpose of developing an appropriate research model and specifying the research hypotheses. The theories or models that are analysed hereunder are the Green IT adoption model (GITAM), the Green-readiness framework (G-readiness), the belief-action-outcome framework, the theory of reasoned action (TRA), the theory of planned behaviour (TPB) and the decomposed theory of planned behaviour (DTPB).

2.4.5.2 Green IT adoption model (GITAM)

The Green IT adoption model (GITAM), as proposed by Molla (2008), is a prevalent model in the Green IT domain. The model theorises that an organisation’s intention to adopt Green IT and the adoption of Green IT is motivated by Green IT readiness, Green IT context and Green IT drivers (Molla, 2008; Thomson & Belle, 2015; Molla et al., 2008). Both Green IT context and Green IT readiness influence Green IT drivers, intention to adopt Green IT and Green IT adoption. Green IT context refers to the characteristics of the existing technology and Green IT readiness refers to an organisation’s readiness and preparation for Green IT (Molla, 2008). Green IT drivers are variables that can influence the content, process and practices of Green IT and are categorised as economic, regulatory or ethical drivers (Molla, 2008). Figure 1 presents GITAM. While this model directly relates to Green IT, its suitability for this study is limited because it applies to organisational Green IT adoption and does not focus on an individual’s behavioural intention and actual behaviour.

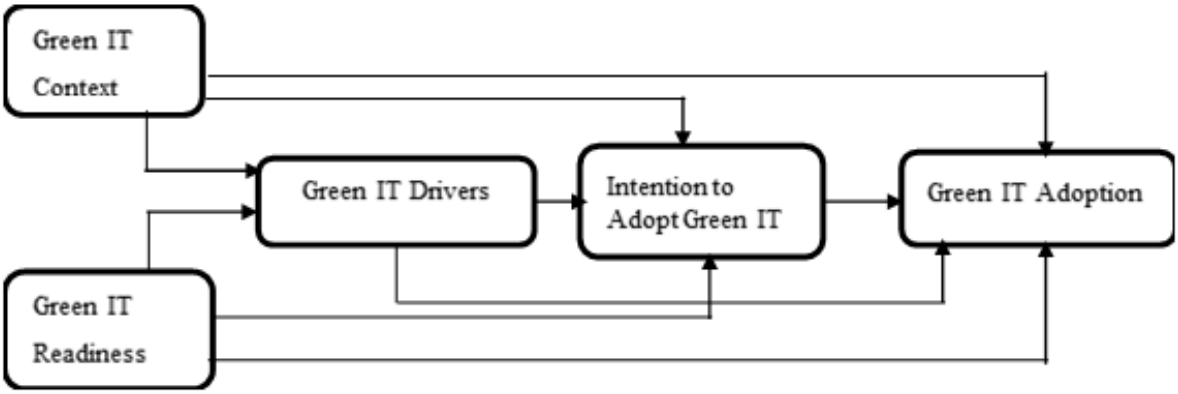

Figure 1: Green IT adoption model (GITAM) (Molla, 2008, p. 660)

2.4.5.3 Green-readiness framework (G-readiness)

Another influential model or framework in the Green IT domain is the G-readiness framework (Molla et al., 2008). The framework was adapted from the e-readiness framework (Molla et al., 2008). The framework is proposed to measure an organisation's ability to apply Green IT (Molla et al., 2008). The measures or parts of the G-readiness framework which are regarded as essential when Greening IT are attitude, policy, practice, technology and governance (Molla & Cooper, 2009).

The attitude dimension measures the knowledge and awareness of IT and business professionals about the environmental issues linked to the usage of IT and the role of IT in solving environmental issues (Molla & Cooper, 2009). The policy dimension measures the level at which Green and sustainability policies are developed throughout an organisation and include IT sourcing, operations, services and end of life (Molla & Cooper, 2009). The practice dimension measures to what extent an organisation has translated its concerns and policies into actions. The technology dimension measures the use of IT in reducing energy consumption, optimising energy efficiency and minimising the organisation's environmental footprint (Tenhunen, 2011). The governance dimension measures the administration of Green IT initiatives, is linked to the policy dimension (Tenhunen, 2011), and comprises both IT governance and environmental governance.

Figure 2 shows the G-readiness framework. This framework is useful for determining an organisation's readiness to implement Green IT. However, similar to GITAM, it does not consider an individual's behavioural intention and actual behaviour. Thus, its suitability for this study is also limited.

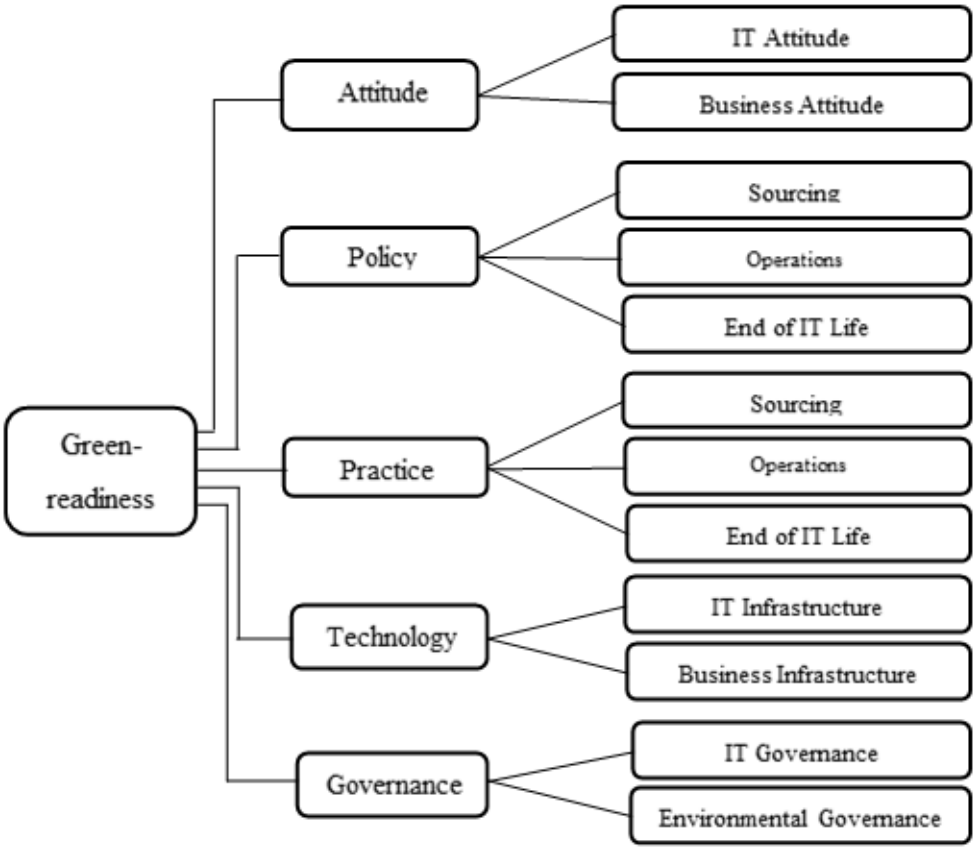

Figure 2: Green-readiness framework (G-readiness) (Molla et al., 2008, p. 672)

2.4.5.4 Belief-action-outcome (BAO) framework

The belief-action-outcome (BAO) framework was developed by Melville (2010). Melville (2010) adapted Coleman's (1986) micro-macro model to propose the BAO framework (Molla et al., 2014). The constructs of the BAO framework, shown in Figure 3, include societal structure, beliefs about environment, organisational structure, behaviour of social system, sustainability actions and behaviour of organisation (Melville, 2010). The constructs are connected by links between macro and micro dimensions and the links help to understand sustainability belief and action formation (Molla et al., 2014). There are three aspects of sustainability that are considered by the model, namely, belief formation, sustainability practices and actions and environmental and financial outcomes (Molla et al., 2014; Melville, 2010). The societal structure and organisational structure dimensions are believed to influence personal beliefs about the environment that may or may not convert into sustainability actions (Molla et al., 2014). Figure 3 shows the BAO framework. Once again, this framework is more appropriate for an organisational environment. Thus, its suitability for this study is limited.

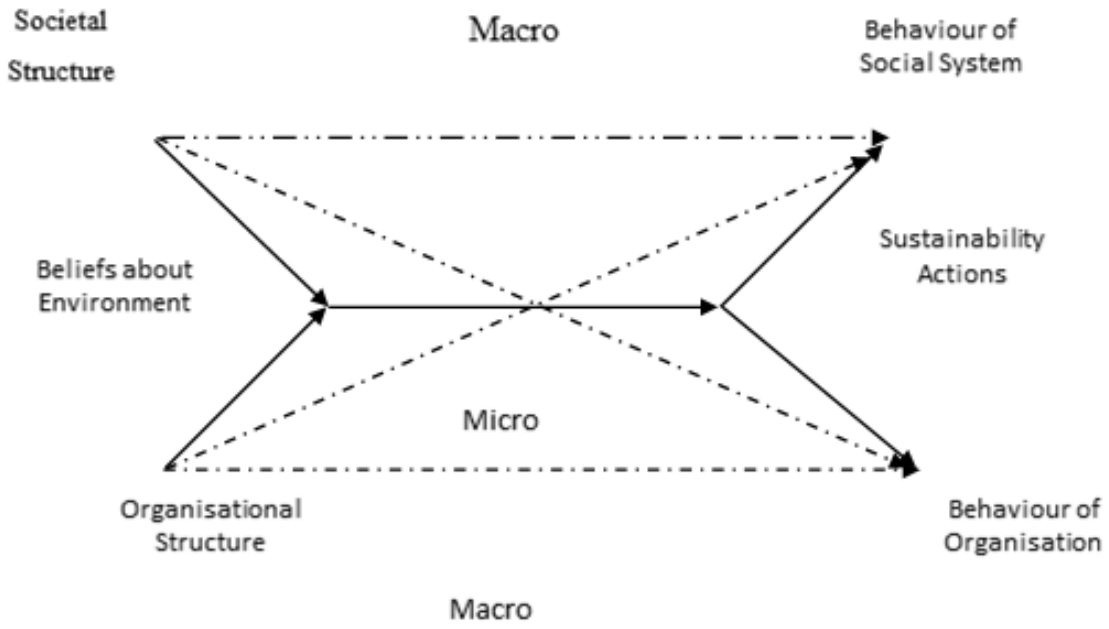

Figure 3: Belief-action-outcome (BAO) framework (Melville, 2010, p. 6)

2.4.5.5 Theory of reasoned action (TRA)

The theory of reasoned action (TRA) was developed by Martin Fishbein and Icek Ajzen in the nineteen sixties and seventies (Fishbein & Ajzen, 1975; Charalabidis & Koussouris, 2012). TRA explains that behavioural intention is an individual's subjective likelihood that he or she will take part in a given behaviour (Fishbein & Ajzen, 1975). TRA suggests that the most important indicator of actual behaviour is behavioural intention (Chow & Chen, 2009). Behavioural intention is, in turn, determined by attitude toward the behaviour and the subjective norm regarding the behaviour (Chow & Chen, 2009). Behavioural intention, in the context of this study, relates to student teachers' intention to teach Green IT. TRA predicts behavioural intention and behaviour quite well (Sheppard, Hartwick, & Warshaw, 1988) and it is useful for identifying where and how to target strategies for changing behaviour. However, TRA has been criticised for not necessarily explaining behavioural change, which is a primary concern in other research fields such as health education and health education programs (Sharma & Romas, 2012). In addition, TRA may be criticised for not providing detailed and specific guidance for behaviour modification. Another criticism of TRA is that it does not consider personality-related factors such as culture and demographic variables, which also shape behaviour (Sharma & Romas, 2012). A diagrammatic representation of TRA is shown in Figure 4.

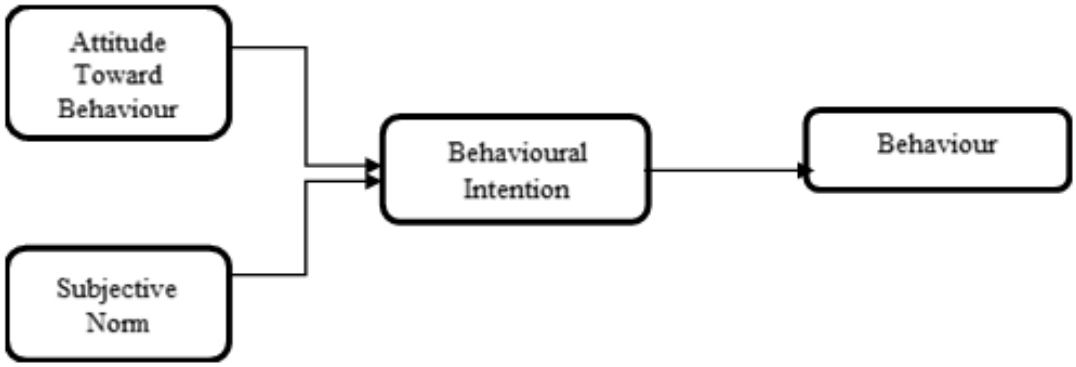

Figure 4: Theory of reasoned action (TRA)

2.4.5.6 Theory of planned behaviour (TPB)

The theory of planned behaviour (TPB) is an expansion and augmentation of TRA for wider theoretical application (Fang & Shih, 2004; Bamberg, Ajzen, & Schmidt, 2003). According to TPB, behavioural, normative and control beliefs have an effect on human behaviour (Ajzen, 2006). Behavioural beliefs refer to the anticipated outcomes of a behaviour, normative beliefs refer to the perceived behavioural expectations of significant others and control beliefs refer to the perceived presence of variables that may enable or obstruct performance of a behaviour (Ajzen, 2006). TPB extends TRA by adding these constructs (Ajzen, 1991). Several authors point out that TPB is an important theoretical framework for recognizing the variables that predict behavioural intention for a particular behaviour (Taylor & Todd, 1995; Lee, 2008). TPB has helped scholars to understand the variables that influence people's intentions to behave in certain ways (Lim & Dubinsky, 2005).

In addition, by adding perceived behavioural control, TPB better explains the relationship between behavioural intention and actual behaviour (Ajzen, 1989). Thus, the intention to perform a behaviour can be predicted with greater accuracy using attitude toward behaviour, subjective norm and perceived behavioural control (Ajzen, 1991). TPB covers people's non-volitional behaviour, which is not covered by TRA.

Nevertheless, TPB has also received criticism. TPB has been criticised for not addressing the potential changes in an individual's beliefs and attitude toward behaviour over time (Bosworth, Oddone, & Weinberger, 2006) and that it is primarily an account of goal setting rather than goal pursuit, so, it is not well equipped to explain patterns of behaviour (Bosworth et al., 2006). In addition, it has been criticised for not explaining behavioural change and not providing detailed and specific guidance for behavioural modification. In due course, TPB was extended to become the decomposed theory of planned behaviour (DTPB) (Taylor & Todd, 1995a). TPB is shown diagrammatically in Figure 5.

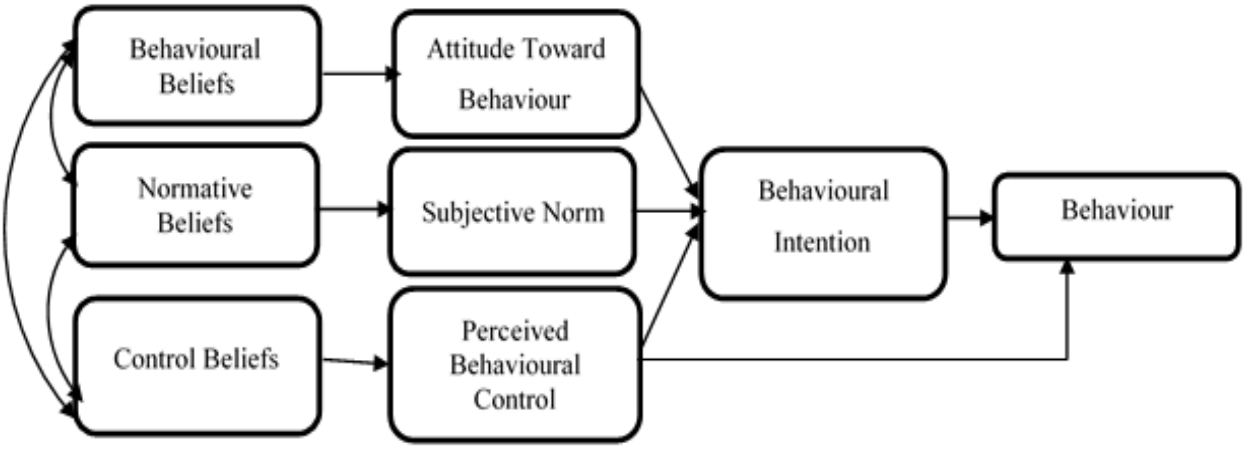

Figure 5: Theory of planned behaviour (TPB) (Ajzen, 2006)

2.4.5.7 Decomposed theory of planned behaviour (DTPB)

The decomposed theory of planned behaviour (DTPB) is an extension of the TPB (Taylor & Todd, 1995; Timothy & Peggy, 2013; Husin & Rahman, 2016). In DTPB, attitude toward behaviour, subjective norm and perceived behavioural control are decomposed into a set of salient belief structures (Fang & Shih, 2004; Timothy & Peggy, 2013). Attitude toward behaviour is decomposed into relative advantage, complexity and compatibility; subjective norm is decomposed into normative influences and perceived behavioural control is decomposed into efficacy and facilitating conditions (Taylor & Todd, 1995a).

Relative advantage often includes innovation, economic benefits, social prestige and further advantages (Rogers, 1995). Complexity defines the difficulty in comprehension, learning or management (Rogers, 1995). Compatibility refers to consistency with current qualities, past experience and current needs (Rogers, 1995). Efficacy refers to the ability to produce the desired results, and facilitating conditions alludes to the existing physical and technological resources (Hernandez & Mazzon, 2007). The pioneers of DPTB believed that the theory gave a better understanding of the belief structures and antecedents of intention (Taylor & Todd, 1995a), and promoted a better understanding of behavioural intention and behaviour (Fang & Shih, 2004; Timothy & Peggy, 2013). Figure 6 depicts DTPB. Nevertheless, DTPB has been shown to be mostly applicable to the adoption and utilization of new technology (Hernandez & Mazzon, 2007) with constructs referring to aspects of using technology, which may not transfer well into this study's teaching context where there is no technology use, Thus, its suitability for this study is also limited.

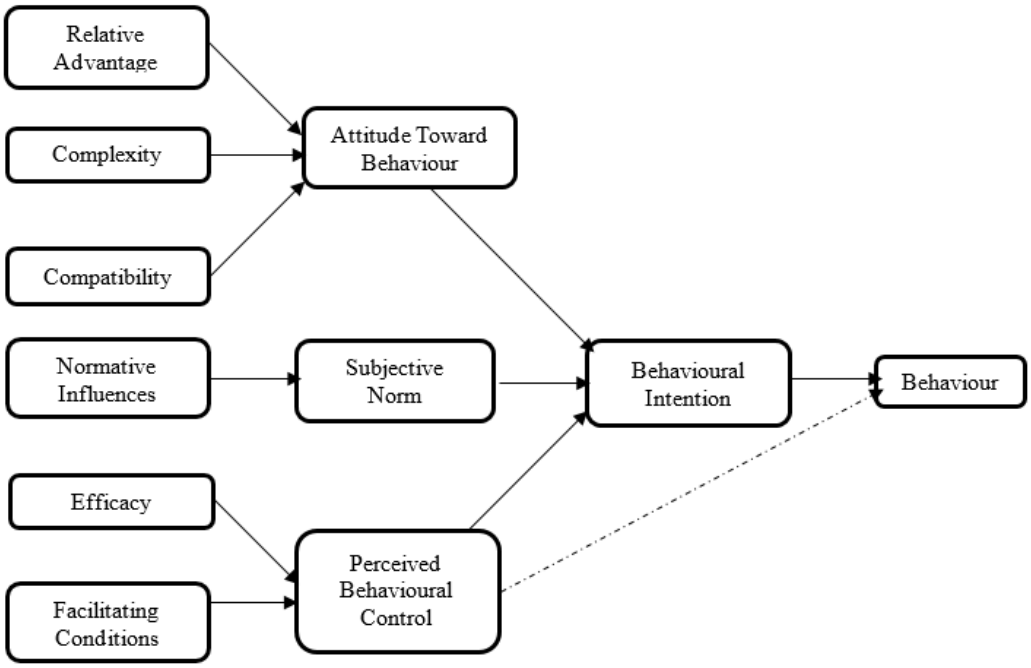

Figure 6: Decomposed theory of planned behaviour (DTPB) (Taylor & Todd, 1995a, p. 142)

2.4.5.8 Research model for the study

Following the preceding analysis, only two out of the six theories, frameworks and models provide a best fit to this study's specific research problem and objective. The two are TRA and TPB. These are the best fit because they explain the antecedents to an individual's behaviour, which can appropriately be applied to teaching behaviour. Thus, the theoretical framework or research model for this study is based on TRA and TPB. Furthermore, TRA and TPB have explained behaviour resulting in insightful research, which includes research in the Green IT and IT domain (Chow & Chen, 2009; Chen et al., 2015; Mishra et al., 2014; Mancha, Muniz, & Yoder, 2014; Choon, Sulaiman, & Mallasi, 2014; Loo, Yeow, & Eze, 2014; Akman & Mishra, 2015; Greaves, Zibarras, & Stride, 2013; de Leeuw, Valois, Ajzen, & Schmidt, 2015). In addition, relevant previous research has combined TRA and TPB for their specific research purposes, which is what the current study has done. For example, Chow and Chen (2009) combined TRA and TPB and they found that attitude toward behaviour, subjective norm and perceived behavioural control influence intention to exercise Green IT.

Accordingly, combining the two theories provides valuable insight into the antecedents of behaviour in Green IT research and provides an appropriate research model for addressing the research problem and achieving the research objective, which is to understand how to improve student teachers' intention to teach Green IT. The findings are expected to explain the relationships and the various antecedents to teaching Green IT, in order to understand how to improve student teachers' intention to teach Green IT and consequently their actual behaviour of teaching Green IT.

In addition to combining TRA and TPB, this study's research model adds two more factors drawn from a study by Mishra, Akman and Mishra (2014). These two factors are person-related beliefs and level of awareness. Including these additional factors is important because both these factors are indicated as influencers of Green IT behaviour (Mishra et al., 2014). Specifically, Mishra et al. (2014) found that person-related beliefs and level of awareness have a direct impact on attitude toward behaviour, intention and actual behaviour (Mishra et al., 2014). The practice of augmenting TRA, which is an earlier version of TPB, with additional variables is an accepted research practice for addressing specific research contexts (Beadnell et al., 2008; Butler, 1999; Crosby, & Muehling, 1983; Yagmaei, 2010). This study's research model is presented in Figure 7. In addition, in this study, the research model is applied at an individual level of analysis. This research model, based on all the preceding justifications, is an appropriate research model for analysing the behavioural drivers of teaching Green IT and, thus, answers the study's first research question.

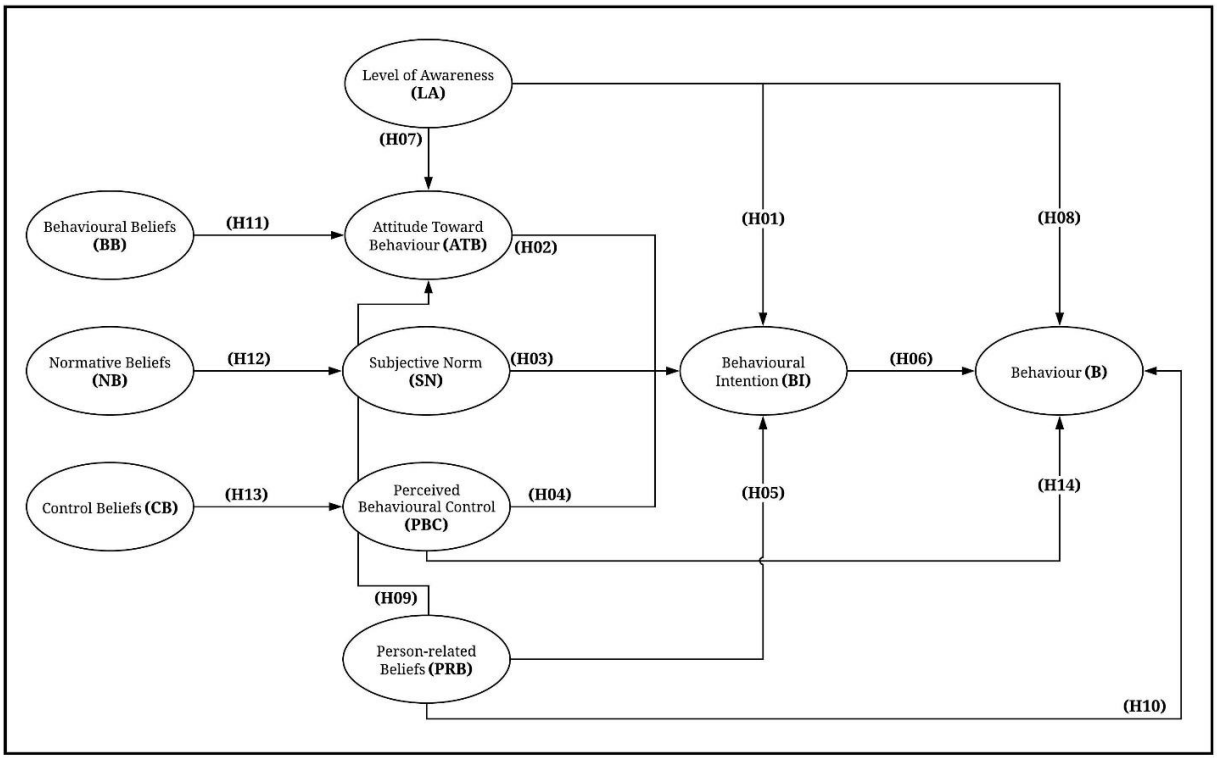

Figure 7: Research model

2.4.6 Research model construct clarification

2.4.6.1 Attitude toward behaviour

The construct of attitude toward behaviour refers to sentiments about a specific phenomenon (Schwartz, 1992; Mishra, Akman, & Mishra, 2014). Attitude toward an intended behaviour can be regarded as the extent to which a person has a positive or negative evaluation or appraisal of the intended behaviour (Teo & van Schaik, 2012). In this study, attitude toward

behaviour refers to the extent to which a person has a positive or negative evaluation or appraisal of teaching Green IT. It has also been argued that the principal variable determining intent to behave is the individual's attitude toward behaviour (Chow & Chen, 2009). Research has shown that attitude toward behaviour influences behavioural intention (Chen et al., 2015). In this study's research model, attitude toward behaviour is an antecedent of behavioural intention. This means that attitude toward behaviour focuses on each student teacher's attitude towards teaching Green IT.

2.4.6.2 Subjective norm

Subjective norm refers to the social pressure perceived by an individual to behave or not behave in a certain way (Ajzen, 1991). In other words, a subjective norm is the personal viewpoint of an individual as to whether performing a particular behaviour is supported by important people in a specific situation (Fishbein & Ajzen, 1975; Chu & Chen, 2016). In this study, subjective norm refers to a student teacher's perceptions about whether people important to him/her will approve of him/her teaching Green IT.

In the research model, subjective norm directly influences behavioural intention (Fishbein & Ajzen, 1975). The rationale is that individuals may choose to perform or not perform a behaviour based on their perception of what other people think (Venkatesh & Davis, 2000). Some studies have found that subjective norm has a strong positive effect on the intention to perform a behaviour (Chen et al., 2015; Taylor & Todd, 1995). However, other studies have found no relationship between subjective norm and intention to perform a behaviour (Mathieson, 1991). For example, in a study that investigated the Green IT behaviour among individuals, it was found that subjective norm had no relationship with Green IT practice (Loo et al., 2014).

2.4.6.3 Perceived behavioural control

Perceived behavioural control refers to an individual's perception of the ease or difficulty of performing a particular behaviour (Ajzen, 1991). As a result, perceived behavioural control is determined by the degree that people believe they have control to perform the behaviour (Greaves et al., 2013). de Leeuw et al. (2015) found that perceived behavioural control is a significant predictor of intention to engage in a behaviour. However, other researchers have found that perceived behavioural control has no relationship with behavioural intention (Sentosa & Mat, 2012; Greaves et al., 2013). In this study, perceived behavioural control is defined to be a student teacher's perception of the ease or difficulty of teaching Green IT (Ajzen, 1991), and is proposed to have a relationship to behavioural intention and behaviour.

2.4.6.4 Behavioural beliefs

Generally, a belief refers to an acceptance that something is true, especially without proof. A behavioural belief is the subjective probability that the behaviour will lead to a particular outcome (Mathieson, 1991). In this study, behavioural belief refers to a student teacher's subjective probability that teaching of Green IT would lead to a particular outcome. In TPB, behavioural beliefs are assumed to precede attitude toward behaviour (Ajzen, 1991; Rutter & Bunce, 1989). So, attitudes come from beliefs people hold about the object of the attitude (Ajzen, 1991). People develop beliefs about an object by connecting it with certain attributes (Ajzen, 1991). The terms object and attribute are used in the generic sense and refer to any discernible aspect of an individual's world. Each belief is considered to connect behaviour to a specific outcome or to some other attribute (Armitage & Conner, 2001). People tend to acquire attitudes towards a behaviour because the attributes that are linked to the behaviour are valued positively or negatively (Ajzen, 1991). Thus, attitude toward a behaviour is influenced by the beliefs that are important to the individuals (Armitage & Conner, 2001).

2.4.6.5 Normative beliefs

Normative beliefs are the antecedent to subjective norm (de Leeuw et al., 2015; Ajzen, 1991; Mathieson, 1991; Armitage & Conner, 2001). A normative belief is an individual's insight of an important other's opinion about the performance of the behaviour (Mathieson, 1991). An important other refers to an individual or a group of people whose opinion/s might be significant to the individual performing the behaviour (Mathieson, 1991). In this study, a normative belief refers to a student teacher's perception of important others' opinions about the student teacher's teaching of Green IT.

2.4.6.6 Control beliefs

Control beliefs are the antecedent to perceive behavioural control and are concerned with the perceived power of specific factors to facilitate or inhibit performance of the behaviour (Ajzen, 1991; Armitage & Conner, 2001; Greaves et al., 2013). Perceived behavioural control is increased by salient beliefs concerning adequate resources and opportunities and fewer anticipated obstacles or impediments (Armitage & Conner, 2001). Control beliefs are assumed to provide the basis for perceptions of behavioural control (Ajzen, 1991). In this study, control beliefs refer to the perceived presence of factors that may facilitate or impede the teaching of Green IT.

2.4.6.7 Level of awareness

Generally, awareness refers to having knowledge or showing perception of a fact, situation or phenomenon (Abbate, 2015). In addition, the literature has shown that people who are aware and mindful about the environment behave in an environmentally sustainable manner (Amel

et al., 2009). In this study, awareness refers to having knowledge about Green IT. In the research model, level of awareness is shown to have a relationship with attitude toward behaviour, behavioural intention and behaviour, since level of awareness has been found to influence all three constructs (Mishra et al., 2014). Notably, other scholars have observed no relationship between level of awareness and actual behaviour regarding environmental issues (Do Valle, Reis, Menezes, & Rebelo, 2004). Mitomo and Otsuka (2012) have pointed out that individuals may have sufficient knowledge about environmental issues but they may not behave in a sustainable manner.

2.4.6.8 Person-related-beliefs

In the context of this study, person-related beliefs refer to the subjective acceptance that a particular object has a certain attribute (Fishbein & Ajzen, 1975). Person-related beliefs, in the study by Mishra, Akman and Mishra (2014), evaluate respondents' perceptions about the role of software developers, hardware manufacturers and IT users in practicing Green IT. This study follows the aforementioned approach, but replaces software developers, hardware manufacturers and IT users with student teachers, since this study is about student teachers teaching Green IT. Thus, this study evaluates respondents' perceptions about the role of student teachers in advancing the Green IT practices of others.

2.4.6.9 Behavioural intention

Behavioural intention refers to a person's resolve to act in a certain way. In this study, behavioural intention refers to student teacher's resolve to teach Green IT. In the research model, behavioural intention is influenced by level of awareness, attitude toward behaviour, subjective norm, perceived behavioural control and person-related beliefs. Research has demonstrated that there is a clear relationship between the behavioural intention and an individual's attitude toward behaviour, subjective norm and perceived behavioural control (Chiyangwa, 2014).

Furthermore, in TRA and TPB, behavioural intention is considered the central factor that provides the best prediction of actual behaviour (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980). In TRA, behavioural intention is directly linked with subjective norm and attitude toward behaviour (Taylor & Todd, 1995a). In TPB, although behavioural intention is the predictor of behaviour, it is considered in conjunction with perceived behavioural control (Ajzen, 2006).

2.4.6.10 Behaviour

Generally, behaviour refers to an individual's conduct. According to TRA, a person's conduct is determined by his or her intention to behave or act in that way, which, in turn, is jointly determined by the person's attitude and subjective norm concerning the behaviour in question

(Davis et al., 1989; Fisbein & Ajzen, 1975). In this study, behaviour refers to teaching Green IT. In the research model, behaviour is influenced by behavioural intention, level of awareness, perceived behavioural control and person-related beliefs. Behaviour is also indirectly influenced by attitude toward behaviour and subjective norm**.**

2.4.7 Research hypotheses

Based on the research model in Figure 7, the research hypotheses are stated below. All are specified as alternate hypotheses (H_A1-10), where the null hypotheses ($H_0$1-10) corresponding to the alternate hypotheses, indicate that there is no association among each set of constructs:

1. Level of awareness (LA) positively influences behavioural intention (BI).
2. Attitude toward behaviour (ATB) positively influences behavioural intention (BI).
3. Subjective norm (SN) positively influences behavioural intention (BI).
4. Perceived behavioural control (PBC) positively influences behavioural intention (BI).
5. Person-related beliefs (PRB) positively influences behavioural intention (BI).
6. Behavioural intention (BI) positively influences behaviour (B).
7. Level of awareness (LA) positively influences attitude toward behaviour (ATB).
8. Level of awareness (LA) positively influences behaviour (B).
9. Person-related beliefs (PRB) positively influences attitude toward behaviour (ATB).
10. Person-related beliefs (PRB) positively influences behaviour (B).
11. Behavioural beliefs (BB) positively influence attitude toward behaviour (ATB).
12. Normative beliefs (NB) positively influence subjective norm (SN).
13. Control beliefs (CB) positively influence perceived behavioural control (PBC).
14. Perceived behavioural control (PBC) influences behaviour (B).

2.5 Chapter summary and conclusions

Chapter Two provided an analysis and synthesis of the following themes relevant to the research problem, namely: environmental sustainability and related concepts; student teachers, teachers and sustainability; Green IT; students' awareness of and attitudes and intentions toward Green IT and applicable theories, frameworks and models.

Chapter Two achieved the following specified objectives, namely: it explained the literature review process to demonstrate a rigorous literature review, uncovered key theories, models, frameworks and phenomena in the domain, clarified the contribution of the research, developed an appropriate research model and specified the research hypotheses. As such, the chapter achieved its goal, which was to analyse and synthesise past research that relates to Green IT and present an appropriate research model for analysing the behavioural drivers of teaching Green IT, to answer research question one.

In conclusion, Chapter Two exposed the relevant and appropriate theories, models and frameworks in the research domain for addressing the research problem and achieving the research objective. Thus, the research model provides the means to investigate and explain the relationships and antecedents to teaching Green IT, in order to understand how to improve student teachers' intention to teach Green IT and consequently their actual behaviour of teaching Green IT.

This chapter has value for academics since it provides a process for conducting a literature review, including searching, analysing and synthesising. Furthermore, Chapter Two explained the appropriate theories of behaviour and justified the research model for the study's specific research problem and objectives. This chapter also has value for teaching practice by exposing the importance of Green IT, the need to teach Green IT, and the important aspects affecting behaviour, which transfer to the teaching of Green IT.

Chapter Three follows, which presents the research methodology applied in the study. Chapter Three details and justifies the study's methodological choices, explains how rigour is maintained and presents the processes involved in gathering and analysing the empirical data.

Chapter 3: Research Methodology

3.1 Chapter introduction

The preceding chapter, Chapter Two, provided the literature review. Chapter Three presents the research methodology. The goal of Chapter Three is to define and justify the research methodology for answering research question two. In order to achieve this goal, Chapter Three has the following specific objectives: detailing and justifying the research strategy with reference to the study's research problem, objective and questions, substantiating the sampling and data collection methods, developing the data collection instrument, explaining how bias is mitigated, detailing research quality, rigour and research ethics, and presenting the data analysis method.

The Chapter Three sections that follow are the research philosophy, the methodological choice and research strategy. Then, the sampling and data collection techniques and procedures are explained and the development of the data collection instrument is detailed. Thereafter, bias types and mitigation, research quality, rigour and research ethics are discussed. Subsequently, the data analysis-principles and processes are provided. The final section in the chapter is the summary and conclusion section.

3.2 Research philosophy

Research philosophy refers to perceptions, beliefs and assumptions about the nature of reality, truth and knowledge (Saunders & Tosey, 2012). Research philosophy is important for research because it has implications for the many subsequent research design choices throughout a study. Common research philosophies in Information Systems (IS) research include positivism and interpretivism.

Positivism is often associated with techniques that employ the scientific method of studying human action (Schwandt, 2007). The key beliefs that are commonly associated with positivism include causation, deductive reasoning, equivalence of problems to those in the natural sciences and dealing with systems (Brewer, 2003). In positivism, observing and predicting outcomes, producing law-like generalisations and using the scientific method to suggest and examine theories with data are prevalent (Saunders & Tosey, 2012). Researchers adopting this philosophy often work with quantitative data and hence hypothesis testing is typically part of the research (Saunders & Tosey, 2012). Thus, positivism primarily involves research with numerical data, which are used to measure and explain social phenomena statistically (Brewer, 2003).

In comparison, interpretivism is a research philosophy that is usually associated with qualitative approaches and natural settings (Saunders & Tosey, 2012; Hurworth, 2005). In interpretivism, social reality is assumed to include a subjective component and the creation and exchange of social meanings results from social interaction (Monette, Sullivan, & DeJong, 2013). Thus, researchers who adopt this philosophy to guide their studies usually analyse data qualitatively and use in-depth investigations involving few subjects (Saunders & Tosey, 2012). Nevertheless, this research study adopts a positivistic research philosophy because this philosophy provides a perspective sufficient to address the research problem and research objective, which involves quantitative data and hypothesis testing.

3.3 Methodological choice

Methodological choice refers to choices about using quantitative or qualitative methods or mixtures of both (Saunders & Tosey, 2012). Generally, quantitative methods are used in studies where theories are tested and relationships are examined between variables using statistical techniques (Creswell, 2014; Flick, 2012). Quantitative methods emphasize objectivity in measuring and describing phenomena (McMillan & Schumacher, 2006). The quantitative method fits the positivist philosophy of the study (UKessays, 2013). In addition, the quantitative method works well in circumstances where a large number of respondents are available (May, 2011).

In comparison, qualitative methods are often used when investigating social or human issues (Creswell, 2014). Interpretivism informs the qualitative approach (Bryman & Allen, 2011). Qualitative studies allow in-depth analyses of human perceptions (Baskas, 2013). It is also possible to mix quantitative and qualitative methods where appropriate for addressing specific research problems (Creswell, 2014; McMillan & Schumacher, 2006).

This study uses quantitative methods, which fits the positivistic research philosophy and enables the study to address the research problem and research objective. In addition, representing data numerically helps to improve precision, specify phenomena, enhance objectivity and improve the accuracy of results (Colwell, 2006; Baskas, 2013). In addition, quantitative methods can support generalisation of results from a sample to a whole population (Nykiel, 2007).

3.4 Research strategy

Research strategy follows from methodological choice and refers to the plan for selecting subjects, research sites and data collection procedures for addressing the research problem (McMillan & Schumacher, 2010). Research strategy explains which individuals are to be studied and when, where and under which circumstances (McMillan & Schumacher, 2010).

The goal of a research strategy is to provide credible results (McMillan & Schumacher, 2010). There are a number of different research strategies that can be applied and these include a survey, case study, archival research, ethnography, action research, grounded theory, narrative inquiry and an experiment (Tushi, 2015; Saunders & Tosey, 2012; Su & Al-Hakim, 2010; Creswell, 2003; McMillan & Schumacher, 2010). This study follows a survey strategy in order to address the research problem, achieve the research objective and test the stated hypotheses (Neil, 2008; Monette et al., 2013).

A survey can be classified as a research strategy and a data collection method (McMillan & Schumacher, 2006), and involves asking questions to a sample of people in a short period of time (Monette et al., 2013). A survey is a systematic method of collecting data from a population of interest and is quantitative in nature. The purpose of a survey is to collect quantitative data usually with a structured questionnaire (Neil, 2008).

A survey strategy is appropriate for research that formulates hypotheses for testing (Mitchell & Jolley, 2012), and is suitable where relationships between one or more variables are examined. It is helpful where people's intentions are described in order to explain their behaviour (Mitchell & Jolley, 2012). A survey strategy is suitable for this study because the relationships between the constructs in the proposed research model require measurement to address the research problem. In addition, the survey strategy is consistent with the study's methodological choice and research philosophy.

Furthermore, a survey strategy enables the statistical analysis of data, which promotes objectivity when drawing conclusions from the research (McCormarck & Hill, 1997). It is also an efficient technique for researching large populations (McCormarck & Hill, 1997). Nevertheless, surveys require careful consideration and administration, because, for instance, if a respondent's answers on a questionnaire are imprecise, construct validity can be affected (Mitchell & Jolley, 2010). In addition, if the sample is biased, external validity can be affected (Mitchell & Jolley, 2010). Figure 8 presents an overview of the implementation of the survey research strategy.

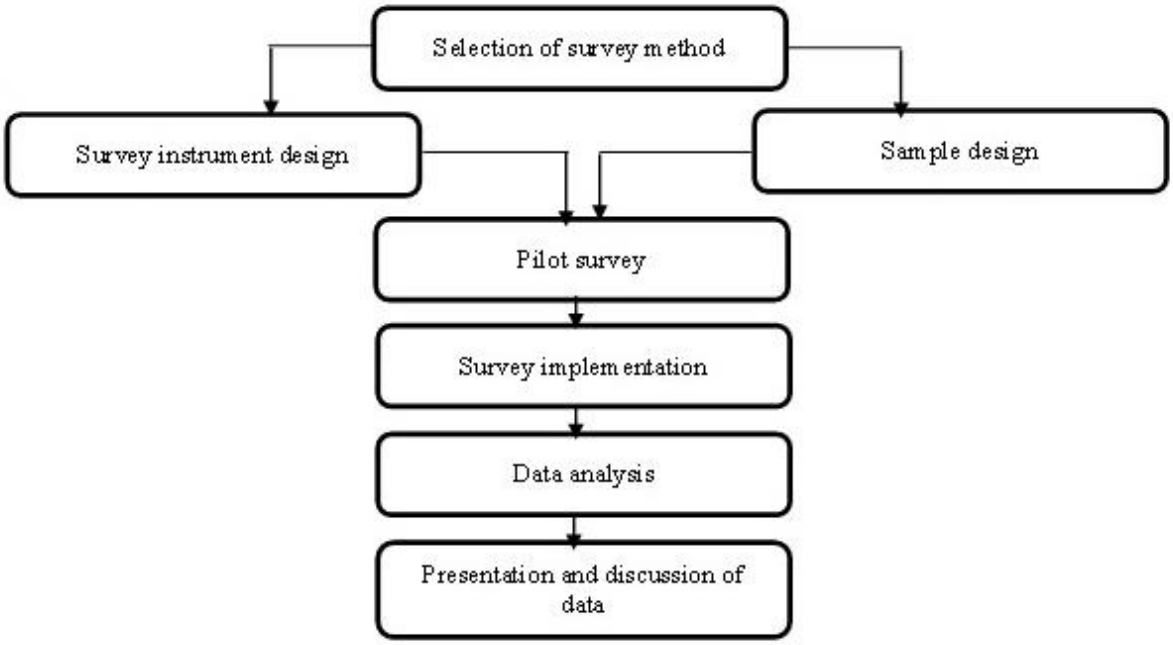

Figure 8: Overview of the implementation of the survey research strategy, adapted from Stopher & Metcalf (1996, p. 11)

3.5 Sampling and data collection

3.5.1 Sampling

A sample refers to a portion of a population (McMillan & Schumacher, 2010). In contrast, a population consists of all subjects or participants that fit the particular research criteria (McMillan & Schumacher, 2010). Data are often collected from a sample instead of an entire population for practical reasons and/or resource constraints. However data collected from a sample can still be used to generalise a study's results to a broader population when appropriate sampling methods are used (McMillan & Schumacher, 2010).

There are two high-level types of sampling methods, namely probability sampling and non-probability sampling (Rivera & Rivera, 2007). In probability sampling, each member or participant in the population has an equal likelihood of being selected (Marlow, 2010). Probability sampling includes techniques such as simple random sampling, interval or systematic sampling, stratified sampling and cluster or multi-stage sampling (Bless, Higson-Smith, & Kagee, 2006). In contrast, non-probability sampling permits a researcher to choose the sample based on his/her subjective judgement (Marlow, 2010). Non-probability sampling includes techniques such as availability sampling, purposive sampling and quota sampling (Bless et al., 2006).

It could be argued that the population for this study is every student teacher across the entire African continent and even across the globe. However, it is not practically possible to access

every student teacher across the entire African continent and even across the globe in one study or even in many extensively resourced studies. Furthermore, it is also not practically possible to obtain a complete list of every student teacher across the entire African continent and even across the globe in order to draw a perfectly random sample.

Therefore, this study follows advice provided in the literature, which recommends proceeding with a purposive sample (Tongco, 2007; Polit & Beck, 2010) that is representative of the main categories of student teachers to which the research problem relates and enables the research problem to be addressed (Grinnell & Unrau, 2008). Importantly, purposive sampling can be used with quantitative surveys. For example, previous studies by Chu, Hsiao, Lee and Chen (2004) and Grover and Segars (2005) have used purposive sampling with quantitative studies. In addition, purposive sampling offers sampling and data that are replicable, solid and relevant. Furthermore, purposive sampling is efficient when used properly because the participants are people who are knowledgeable and relevant. Finally, purposive sampling has no restriction on the sample size (Bernard, 2002), which is important for subsequent analysis using structural equation modeling (SEM).

Notably, purposive sampling is an inherently biased technique and requires caution when used in quantitative studies (Tongco, 2007; Polit & Beck, 2010). Specifically, the selection of participants is open to subjective bias (Lavrakas, 2008). During selection, it is possible to miss a participant with a crucial characteristic relevant to the study (Lavrakas, 2008). Thus, inferences and conclusions drawn from the study may not be applied beyond the sample, which affects external validity. External validity refers to the generalisability of the findings to a broader population (Elwood, 2017). Nevertheless, any study conducted using purposive sampling can be argued to exhibit external validity on the sample (Tongco, 2007) and a study done using purposive sampling contributes to theory because it can be replicated for confirmation in broader populations (Tongco, 2007). In order to mitigate the selection bias, clear criteria are used for selecting participants (Houser, 2016).

The study focuses on student teachers in teacher-training institution/s in the African country of Swaziland. The study did not cover all student teachers in all teacher-training institution/s in Swaziland due to access constraints. Nevertheless, the practicable institutions provide enough data to address the research problem.

Notably, Green IT practices are often not common sense and so it is necessary that Green IT practices are taught to others. Teachers, typically, have the skills and opportunities to influence the behaviour of the many pupils they teach throughout their teaching careers and student teachers, in particular, are viewed as essential agents for imparting Green IT knowledge and instilling Green IT behaviour into future generations since they have their

entire teaching careers ahead of them and should understand contemporary IT and related issues.

Thus, the criteria used for selecting participants in this study are student teachers from teacher-training institutions in the African country of Swaziland, covering all education teaching grade ranges and qualification types and exhibiting a wide range of demographic characteristics. Specifically, the sample consists of student teachers from the following teacher training institutions in Swaziland: [***names removed to maintain participant anonymity***]. The sample of the study is considered representative because it represents all education teaching grade ranges and qualification types for student teachers in Swaziland. Specifically, the teaching grade ranges covered are early childhood, primary and secondary education and the qualification types covered are diplomas and bachelor degrees.

Apart from the sampling method, the sample size is also important. In order to address the research problem effectively, this study uses structural equation modeling (SEM) to analyse the data. Thus, the sample size needs to be large enough to allow for SEM analysis. The literature presents varying views on the required sample size for SEM. Some scholars suggest that SEM requires a large sample size (Kelloway, 2014; Gefen, Straub, & Boureau, 2000; Mishra et al., 2014). This is because a large sample size is needed for the computation of the chi-square statistic and for the estimation methods (Kelloway, 2014). Sample sizes less than two hundred are regarded as problematic because they produce inaccurate results in the estimation methods (Cudeck & Jöreskog, 2001). However, other authors have suggested that certain rules should be followed when selecting sample size. The suggested rules include that the sample size should be ten times more than the number of indicators used to estimate a single construct (Barclay, Higgins, & Thompson, 1995). Accordingly, the study referred to recent Green IT studies that have employed SEM, which have also shown different samples sizes. Table 1 shows the different sample sizes used in recent Green IT studies. The minimum sample size is seventy-eight and the maximum sample size is six hundred and forty-eight. The arithmetic mean is 274.1 and the median is 267. Based on the available participants for this study, the study is able to match the median of 267.

Table 1: Analysis of samples sizes in Green IT studies

Research study reference	Sample size	Data analysis method	Research topic
Greaves et al. (2013)	78	SEM	Using the theory of planned behaviour to identify key beliefs underlying pro-environmental behaviour in high-school students: Implications for educational interventions

Research study reference	Sample size	Data analysis method	Research topic
Mancha et al. (2014)	162	SEM	Studying executives' Green behaviours: An environmental theory of planned behaviour
Mishra et al. (2014)	190	SEM	Theory of reasoned action application for Green Information Technology acceptance
Akman & Mishra (2015)	190	SEM	Sector diversity in Green Information Technology practices: Technology acceptance model perspective
Chow & Chen (2009)	267	SEM	Intended belief and actual behaviour in Green computing in Hong Kong
Chen et al. (2015)	267	SEM	Investigating users' extrinsic motivation for Green personal computing
Ainin, Naqshbandi, & Dezdar (2016)	277	SEM	Impact of adoption of Green IT practices on organizational performance
Molla et al. (2014)	322	SEM	Green IT beliefs and pro-environmental IT practices among IT professionals
Chiyangwa (2014)	340	SEM	Belief and actual behaviour in Green Information Technology within a South African tertiary institution
Dezdar (2017)	648	SEM	Green Information Technology adoption: Influencing factors and extension of theory of planned behaviour

Table 2 shows the initial participant estimates during the planning stage of the study based on the aforementioned Green IT literature median and student teacher enrolment numbers obtained by the researcher at that time.

Table 2: Initial study sample planning estimates

Institution	Number of respondents	Teaching grade range	Qualification type
Institution_01	75	Primary school grades	Primary teacher's diploma
	50	Early childhood grades	Early childhood education diploma
	25	Primary school grades	Diploma in music education
Institution_02	30	Primary and secondary school grades	Bachelor of special and inclusive education
	45	Primary school grades	Primary teacher's diploma
Institution_03	22	Secondary school grades	Secondary teacher's diploma
	20	Primary school grades	Primary teacher's diploma
Total	267		

However, the final participant numbers changed once the actual data collection process occurred as it was many months after the initial planning stage of the study. Table 3 shows the final sample for the study, being a total of three hundred participants. At Institution_01 eighty-one students studying an early childhood education diploma participated. At Institution_02, data were collected from one hundred and seven students, consisting of forty-two students studying a bachelor of special and inclusive education, five students studying bachelor of education in leadership and management and sixty students studying a primary teacher's diploma. At Institution_03, one hundred and twelve students participated, comprising forty-two students studying a secondary teacher's diploma and seventy students studying a primary teacher's diploma.

Table 3: Final study sample during data collection

Institution	Number of actual respondents	Total number of student-teachers (population size)	Teaching grade range	Qualification type
Institution_01	81	200	Early childhood grades	Early childhood education diploma
Institution_02	42	90	Primary and secondary school grades	Bachelor of special and inclusive education
	5	15	Primary and secondary school grades	Bachelor of education in leadership and management
	60	180	Primary school grades	Primary teacher's diploma
Institution_03	42	190	Secondary school grades	Secondary teacher's diploma
	70	200	Primary school grades	Primary teacher's diploma
Total	300	875		

3.5.2 Data collection

In quantitative research, conventional data collection methods include questionnaires, interview schedules and observation schedules (Grooves et al., 2011). Other methods of collecting data in quantitative research include paper-and-pencil tests, internet surveys, structured interviews, telephone surveys and computer assisted personal interviews (Lewis-Beck, Bryman & Futing Liao, 2004; McMillan & Schumacher, 2010).

In this study and consistent with the research strategy, a self-administered questionnaire was used to collect data from respondents. A questionnaire is a data collection instrument that contains items grouped together to gather information about one or more constructs (Salkind, 2007). In particular, the constructs that relate to this study are subjective norm, level of awareness, attitude toward behaviour, perceived behavioural control, person-related beliefs, normative beliefs, control beliefs, behavioural beliefs, behavioural intention, and behaviour.

These constructs are included in the questionnaire in order to test the research model and examine relationships between the constructs. The data obtained from the questionnaire are numeric and statistical methods are used for analysis, which is one of the requirements for survey research (Neil, 2008). Notably, prior Green IT research has successfully tested these constructs using questionnaires (Chow & Chen, 2009; Chen et al., 2015; Akman & Mishra, 2015).

Further benefits of using a questionnaires include accessibility, bias mitigation, anonymity and an increased response time for respondents (Gratton & Jones, 2004). In addition, a questionnaire can gather large amounts of data from many people in short time with low costs (Gratton & Jones, 2004). A disadvantage of questionnaires is often a low response rate (Hill & Alexander, 2006). A response rate refers to the quantity of completed questionnaires divided by the number questionnaires eligible for completion (Fink, 2012). Studies can increase the response rate by explaining the purpose and importance of the research to respondents before they complete a questionnaire (Boslaugh, 2008; Fink, 2012).

3.6 Development of the data collection instrument

3.6.1 Measurement scale and item structure

In order to measure the research model, the constructs presented in the research model were included in the questionnaire. Thus, the questionnaire was developed based on the constructs in the research model presented in Sub-section 2.4.5.8. Measuring each construct in the questionnaire was operationalised by presenting a respondent with several indicators or items that reflect each construct and to which a respondent can provide varied responses. Thus, the study's research model constructs were operationalised as variables in the questionnaire, since their values vary depending on the values a respondent assigns to each item in the questionnaire.

When completing the questionnaire, a student teacher evaluated each questionnaire item on a defined measurement scale (Chen et al., 2015). The measurement scale selected for the questionnaire items was the Likert scale, which was developed by Rensis Likert in 1932 in order to measure attitudes scientifically (Garwood, 2011). Likert scales are rating scales often used in questionnaires that measure peoples' attitudes, opinions or perceptions (Jamieson, 2012).

As compared with other scales of measurement, Likert scales are flexible, efficient, easy to construct and have high reliabilities (Alreck & Settle, 2004; Burns & Dobson, 2012; Vogt, 2011). The flexibility of Likert scales is usually shown in the wording of the statements (Alreck & Settle, 2004). Likert scales are efficient, because one set of instructions and scale

can serve many items and once a respondent understands what is required, he or she can complete the rest of the items quickly (Alreck & Settle, 2004). Several scholars who have studied attitude toward behaviour, subjective norm, behavioural intention and behaviour have used Likert scales in their studies (Chen et al., 2015; Mishra et al., 2014; Chow & Chen, 2009; Choon, Sulaiman, & Mallasi, 2014; Greaves, Zibarras, & Stride, 2013). The internal consistency reliabilities of their researched variables have also been above 0.7, which can be considered reliable. Likert scaling is also referred to as a method of summated ratings (Fabrigar & Wood, 2011; Gibbon, Moore, & Winski, 1997; Alreck & Settle, 2004). This means that all questions constituting a concept or sub-concept can be summed to give a composite response (Gibbon, Moore, & Winski, 1997). However, Likert scales require a degree of literacy to complete and a level of expertise and statistical sophistication to develop (Guiloff, 2013).

Closely related to the measurement scale is the structure of the items to which the measurement scale refers. The structure of the items in this study is closed-ended. As such, respondents are provided with a fixed number of responses to each item (Lavrakas, 2008). Closed-ended items are suitable for subsequent quantitative analysis (Given, 2008). In addition, closed-ended items result in efficient data collection and respondents can answer the items easily and quickly (Ary, Jacobs, Razavieh, & Sorensen, 2009; Polit & Beck, 2008). Moreover, closed-ended items are useful in situations where respondents have difficulty in expressing themselves verbally (Polit & Beck, 2008). However, using closed ended items does not guarantee that respondents provide genuine responses (Ary et al., 2009). In order to mitigate any limitations of the closed-ended items, the guidelines for writing items as suggested by Cohen, Manion and Morrison (2000) have been followed. These guidelines include avoiding leading and complicated items and formulating both instructions and responses for clarity and ease of response.

Thus, the study's questionnaire comprised sets of items to which respondents responded with agreement or disagreement according to a Likert measurement scale (Kumar, 2008). Specifically, the measurement scale used provided for a range of five possible responses to each item, namely "strongly agree", "agree", "neither agree nor disagree", "disagree" and "strongly disagree". The categories of responses were coded numerically for subsequent statistical analyses, namely 1="strongly disagree", 2="disagree", 3="neither disagree nor agree", 4="agree" and 5="strongly agree" (Jamieson, 2012). Notably, increasing the scale to seven or nine points has not been shown to improve reliability, so the five-point scale was used (Sekaran & Bougie, 2009).

3.6.2 Relevant construct measurement items from the literature

A research instrument is a tool for collecting data and sometimes is it called a data collection instrument or research tool (Ariola, 2006). For research to be credible, the research instrument must be appropriate, valid and reliable (Ariola, 2006; Straub, 1989). The data collection instrument for this study is a self-administered survey questionnaire. The questionnaire is developed based on the constructs in the study's research model presented in Sub-section 2.4.5.8. The questionnaire items that represent each construct in the research model have been adapted from relevant, validated and reliable prior studies as listed and referenced in Tables 4 to 13. The constructs are: level of awareness, attitude toward behaviour, subjective norm, perceived behavioural control, person-related beliefs, control beliefs, behavioural beliefs, normative beliefs, behavioural intention and behaviour.

The questionnaire consisted of two sections. The first section was Section A, which gathers a student teacher's demographic information. This information includes gender, age, home language, year of study, planned teaching grade range, qualification type and teaching experience. The aforementioned demographics are important because they define the characteristics of the sample (Myse, 2012).

The next section of the questionnaire was section B, which measured each of the constructs in the study's research model. Since these constructs have been successfully measured in prior research, albeit in varying contexts, Tables 4 to 13 present the exact items as they have appeared in the literature for measuring each of the constructs in the research model. Tables 4 to 13 present items from the literature that are most suitable for adaptation to the study's research problem and objective. The items were first extracted from relevant Green IT literature and then from other literature. Thus, Tables 4 to 13 show items from previous Green IT literature as far as possible and then from other literature that successfully operationalised the constructs used in the study's research model.

Table 4: Construct: Attitude toward behaviour

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
Attitude toward behaviour	ATT (attitude) 1. For me, practising green computing is good.	Measurement Scale of 1 to 5, where 5 = "Strongly agree" and 1 = "Strongly disagree".	Chow & Chen (2009); Chen et al. (2015); Choon et al. (2014)	0.896 (Cronbach's alpha – internal consistency)	• Convergent validity (scale factor analysis and factor loadings of 0.61 above found in all decision variables)	Green Computing
	ATT (attitude) 2. For me, practicing green computing is beneficial.					
	ATT (attitude) 3. For me, practicing green computing is a pleasant one.					
	ATT (attitude) 4. For me, practicing green computing is valuable.					
	ATT (attitude) 5. For me, practicing green computing is enjoyable.					
	2.1 For me the idea of practising green computing on a regular basis is beneficial.	Measurement Scale of 1 to 5, where 5 = "Disagree" and 1 = "Agree".	Chiyangwa (2014)	0.737 (Cronbach's alpha – internal consistency)	• Convergent validity (scale factor analysis and factor loadings)	Belief and actual behaviour in Green Information Technology within a South African tertiary institution
	2.2 For me the idea of practising green computing on a regular basis is good.					
	2.3 For me the idea of practising green computing on a regular basis is valuable.					
	2.4 For me the idea of practising green computing on a regular basis is pleasant.					
	2.5 For me the idea of practising green computing on a regular basis is enjoyable.					
	Practicing GIT (Green Information Technology) is convenient for me.	Measurement Scale of 1 to 5, where 5 = "Very much" and 1 = "Very little".	Mishra et al. (2014)	0.850 (Cronbach's alpha – internal consistency)	• Content validity • Confirmatory factor analysis	Green Information Technology
	Practicing GIT is necessary for me.					
	Practicing GIT is worth it.					
	I would like to join and actively participate in an environmentalist group.	Measurement Scale of 1 to 5, where 5 = "Strongly agree" and	Mancha et al. (2014)	0.70 (Cronbach's alpha – internal	• Convergent validity (Average variance	Studying Executives' Green Behaviours: An Environmental Theory

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
	Protecting the environment is more important than protecting peoples' jobs.	1 = "Strongly disagree".		consistency)	extracted (AVE) of greater than 0.5) • Discriminant validity (Square root of AVE and items loadings >=0.70)	of Planned Behaviour
	Whenever possible, I try to save natural resources					
	I would NOT get involved in an environmentalist organization.					

Table 5: Construct: Subjective norm

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
Subjective norm	SN (subjective norm) 1. Most people who are important to me think that I should practice green computing."	Measurement Scale of 1 to 5, where 5 = "Strongly agree" and 1 = "Strongly disagree".	Chow & Chen 2009; Chen et al. (2015)	0.896 (Cronbach's alpha – internal consistency)	• Convergent validity (scale factor analysis). Factor loadings of 0.61 above found in all decision variables	Green Computing
	SN (subjective norm) 2. It is expected of me that I practice green computing.	Measurement Scale of 1 to 5, where 5 = "Strongly agree" and 1 = "Strongly disagree".	Chen et al. 2015; Chow & Chen (2009)	0.819 (Cronbach's alpha – internal consistency)	• Convergent validity (scale factor analysis and factor loadings of higher than 0.70)	Green Computing
	SN (subjective norm) 3. Many people like me practice green computing.	Measurement Scale of 1 to 5, where 5 = "Strongly agree" and 1 = "Strongly disagree".	Chen et al. (2015)	0.819 (Cronbach's alpha – internal consistency)	• Convergent validity (scale factor analysis and factor loadings of higher than 0.70)	Green Computing
	SN (subjective norm) 4. Most people who are important to me practice green computing.					
	SN (subjective norm) 5. The people in my life whose opinion I value practice Green computing.					

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
	SN (subjective norm) 6. The people in my life whose opinion I value would approve of me practice green computing.					
	I feel under social pressure to turn my PC off whenever I leave my desk.	Measurement Scale of 1 to 5, where 5 = "Strongly agree" and 1 = "Strongly disagree".	Greaves et al. (2013)	0.77 (Cronbach's alpha – internal consistency)	• Convergent validity (confirmatory factor analysis)	Using the theory of planned behaviour to explore environmental behavioural intentions in the workplace
	People who influence my behaviour think that I should use the system. People who are important to me think that I should use the system.	Measurement Scale of 1 to 7, where 7 = "Good" and 1 = "Bad"	Morris, Venkatesh, & Ackerman (2005)	0.80 (Cronbach's alpha – internal consistency)	• Convergent validity (principal component analysis (PCA) and oblimin rotation) • Discriminant validity (principal component analysis (PCA) and oblimin rotation)	Gender and age differences in employee decisions about new technology: An extension to the theory of planned behaviour
	Most people who are important to me think . . . I should/I should not . . . participate in the series of Web surveys. Most people whose recommendations I like to comply with think . . . I should/I should not . . . participate in the series of Web surveys. Most people I would think of when requested to participate in the series of Web surveys would expect me . . . To participate/Not to participate.	Measurement Scale of 1 to 7, where 7 = "Good" and 1 = "Bad"	Bosnjak, Tuten, & Wittmann (2005)	0.77 (Cronbach's alpha – internal consistency)	• Predictive validity (a medium effect size computed)	Unit (Non) response in web-based access panel surveys: An extended planned-behaviour approach
	Most people who are important to me think that I should practise green computing on a regular basis.	Measurement Scale of 1 to 5, where 5 = "Disagree" and 1 =	Chiyangwa (2014)	0.780 (Cronbach's alpha – internal	• Convergent validity (scale factor analysis	Belief and actual behaviour in Green Information Technology

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
	Most people who are important to me practise green computing on a regular basis.	"Agree".		consistency)	and factor loadings)	within a South African tertiary institution
	It is expected of me to practise green computing on a regular basis.					
	Most people in my life whose opinions l value would approve of me practising green computing on a regular basis.					
	Most people in my life whose opinions l value practise green computing on a regular basis.					
	Most people like me because l practise green computing on a regular basis.					

Table 6: Construct: Perceived behavioural control

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
Perceived behavioural control	PBC (Perceived behavioural control) 1. I have total control in improving quality of GIT.	Measurement Scale of 1 to 5, where 5= "Strongly agree" and 1 = "Strongly disagree".	Chow & Chen (2009)	0.775 (Cronbach's alpha – internal consistency)	• Convergent validity (scale factor analysis and factor loadings of 0.61 above found in all decision variables)	Intended belief and actual behaviour in Green computing in Hong Kong
	PBC (Perceived behavioural control) 2. I can improve quality of GIT in the forthcoming months.					
	PBC (Perceived behavioural control) 3. I definitely could improve quality of GIT in the forthcoming months.					

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
	PBC (Perceived behavioural control) 4. It is mostly up to me whether I improve quality of GIT in the forthcoming months.					
	PBC (Perceived behavioural control) 1. I have the resources, knowledge and ability to buy a VCR-Plus +™: (unlikely/likely).	Measurement Scale of 1 to 2, where 2= "Unlikely agree" and 1 = "Likely".	Taylor & Todd (1995a)	0.84 (Cronbach's alpha – internal consistency)	• Construct validity (sorting of items)	Decomposition and crossover effects in the theory of planned behaviour: A study of consumer adoption intentions
	PBC (Perceived behavioural control) 2. I have the resources, knowledge and ability to operate a VCR – Plus +™: (unlikely/ likely).					
	PBC (Perceived behavioural control) 3. I would be able to buy a VCR-Plus +™: (unlikely/likely).					
	PBC (Perceived behavioural control) 4. I would be able to operate a VCR-Plus + ™: (unlikely/likely).					
	PBC1. When providing false information, I have complete control.	Five Item Measurement Scale	Lwin & Williams (2004)	0.77 (Cronbach's alpha – internal consistency)	• Convergent validity (confirmatory factor analysis and all measurement items converged)	A model integrating the multidimensional developmental theory of privacy and theory of planned behaviour to examine fabrication of information online
	PBC (Perceived behavioural control) 2. Providing false information is easy.					
	PBC (Perceived behavioural control) 3. Website features make it difficult for me to provide false information.					
	I am confident that if l wanted to I could practice green computing on a regular basis.	Measurement Scale of 1 to 5, where 5 = "Disagree" and 1 =	Chiyangwa (2014)	0.707 (Cronbach's alpha – internal	• Convergent validity (scale factor analysis	Belief and actual behaviour in Green Information Technology within a South African tertiary

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
	Whether or not l practice green computing on a regular basis is completely up to me.	"Agree".		consistency)	and factor loadings)	institution
	I have total control to improve the practice of green computing.					
	I can improve the practice of green computing in the forthcoming months.					
	I could definitely improve the practice of green computing in the forthcoming months.					

Table 7: Construct: Behavioural beliefs

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
Behavioural belief	Do you think it is easy for you to learn how to practice GIT (Green Information Technology)?	Measurement Scale of 1 to 5, where 5 = "Very much" and 1 = "Very little".	Akman & Mishra (2014)	0.950 (Cronbach's alpha – internal consistency)	• Content validity (Items adopted from prior Green IT studies)	Green Information Technology practices among IT professionals: Theory of planned behaviour perspective
	Do you think you have no problems in practicing GIT?					
	Staying at a green hotel when traveling would enable me to 1. Protect our environment.	Measurement Scale of 1 to 7, where 7 = "Very true" and 1 = "Very false".	Han, Hsu, & Sheu (2010)	0.782 (Cronbach's alpha – internal consistency)	• Construct validity (confirmatory factor analysis) • Convergent validity (AVE ranging from 0.578 to0.909)	Application of the theory of planned behaviour to green hotel choice: Testing the effect of environmental friendly activities

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
	Staying at a green hotel when traveling would enable me to 2. Be more socially responsible.				• Discriminant validity (AVE was greater than squared correlation between constructs)	
	Staying at a green hotel when traveling would enable me to 3. Experience a healthy environment.					
	Staying at a green hotel when traveling would enable me to 4. Perform environmentally friendly practices.					
	Staying at a green hotel when traveling would enable me to 5. Enjoy environmental products and healthy amenities.					
	Staying at a green hotel when traveling would enable me to 6. Eat fresh and healthy foods.					
	Staying at a green hotel when traveling would enable me 7. Have reduced expenses.					

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
	Staying at this green hotel when traveling to the same location next time would enable me to be more socially responsible.'	Measurement Scale of 1 to 7, where 7 = "Strongly disagree" and 1 = "Strongly agree"	Han & Kim (2010)	0.967 (Cronbach's alpha – internal consistency)	• Convergent validity (AVE values greater than 0.50) • Discriminant validity (AVE value exceeded the squared value of each correlation)	An investigation of green hotel customers' decision formation: Developing an extended model of the theory of planned behaviour
	Preparing a variety of foods for my child everyday would lead to improve his/her growth.	Measurement Scale of 1 to 5, where 5 = "Extremely likely" and 1 = "Extremely unlikely."	Annadurai, Danasekaran, & Mani (2017)	0.86 (Cronbach's alpha – internal consistency)	• Content validity (content validity ratio for total scale (.99))	Assessment of salient beliefs affecting mothers; intention to adherence to dietary diversity in their children's complementary feeding
	It would take me (much more/much less) time to do the assignment with [the spreadsheet] than to do the assignment with my calculator.	Measurement Scale of two-item, Much more or Much less	Mathieson (1991)	N/A	• Content validity • Construct validity • Discriminant validity	Comparing the technology acceptance model with the theory of planned behaviour
	Practising Green computing on a regular basis enables me to reduce the consumption of energy.	Measurement Scale of 1 to 5, where 5 = "Disagree" and 1 = "Agree".	Chiyangwa (2014)	N/A	• Convergent validity (scale factor analysis and factor loadings)	Belief and actual behaviour in Green Information Technology within a South African tertiary institution
	Practising Green computing on a regular basis will help me to decrease greenhouse gas emission					

Table 8: Construct: Normative beliefs

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
Normative beliefs	I care what the instructor of this survey thinks I should do.	Measurement Scale of 1 to 5, where 5 = "Disagree" and 1 = "Agree".	Chiyangwa (2014)	N/A	• Convergent validity (scale factor analysis and factor loadings)	Belief and actual behaviour in Green Information Technology within a South African tertiary institution
	I care what close friends, classmates and the whole university think I should do.					
	IT experts care that I should practice green computing.					
	I care what my lecturer think I should do.					
	In general, I believe that my parents (or legal guardians) would favour my using shop-bots to buy books.	Measurement Scale of strongly disagree/ strongly agree	Gentry & Calantone (2002)	N/A	Not given	A comparison of three models to explain shop-bot use on the Web
	In general, I believe that my friends would favour my using shop-bots to buy books.					
	In general, I believe that my professors would favour my using shop-bots to buy books.					
	In general, I believe that my employer would favour my using shop-bots to buy books.					
	Instructors in other courses would (strongly support/strongly oppose) my using [the spreadsheet] rather than my calculator for the assignment.	Measurement Scale of two-item, Strong oppose/Strongly support	Mathieson (1991)	Not given	Not given	Comparing the technology acceptance model with the theory of planned behaviour
	Members of my family or close relatives would approve that I am taking diabetes medicine regularly.	Measurement Scale of eight item Morisky Medication Adherence Scale (MMAS-8)	Wu & Liu (2016)	Not given	Not given	Association between patients' beliefs and oral antidiabetic medication adherence in a Chinese type 2 diabetic population
	NB (Normative Belief) 1: My family (or relatives) thinks I should stay at a green hotel when traveling.	Measurement Scale of 1 to 5, where 5= "Strongly disagree" and 1 = "Strongly agree".	Han et al. (2010)	0.836 (Cronbach's alpha – internal consistency)	• Construct validity (confirmatory factor analysis) • Convergent validity (AVE	Application of the theory of planned behaviour to green hotel choice: Testing the effect of environmental friendly activities
	NB (Normative Belief) 2: My friends think I should stay at a green hotel when traveling.					

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
	NB (Normative Belief) 3: My colleagues (or co-workers) think I should stay at a green hotel when traveling.				ranging from 0.578 to0.909) • Discriminant validity (AVE was greater than squared correlation between constructs)	
	My family (or relatives) thinks I should stay at this hotel when traveling to the same location next time.	Measurement Scale of 1 to 7, where 7= "Extremely likely" and 1 = "Extremely unlikely".	Han & Kim (2010)	0.933 (Cronbach's alpha – internal consistency)	• Convergent validity (AVE values greater than 0.50) • Discriminant validity (AVE value exceeded the squared value of each correlation)	An investigation of green hotel customers' decision formation: Developing an extended model of the theory of planned behaviour
	Generally speaking, I want to do what most health professionals think I should do concerning foods.	Measurement Scale of 1 to 7, where 7 = "Strongly agree" and 1 = "Strongly disagree".	Wheeler & Chapman-Novakofski (2014)	0.70 (Cronbach's alpha – internal consistency)	Not given	Women infant and children program participants' beliefs and consumption of soy milk: Application of the theory of planned behaviour
	Generally speaking, I want to do what my health care provider in particular thinks I should do concerning my diet and the food I eat.					
	Generally speaking, I want to do what my family or people in my household think I should do concerning my diet and the food I eat.					
	My husband think that I should prepare a variety of foods for my child every day.	Measurement Scale of 1 to 5, where = "Extremely likely" and 1= "Extremely unlikely."	Annadurai et al. (2017)		Content validity (expert reviews, and content ratio for total scale (.99))	Assessment of salient beliefs affecting mothers; intention to adherence to dietary diversity in their children's complementary feeding

Table 9: Construct: Control beliefs

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
Control beliefs	I would know how to use [the spreadsheet] for the assignment (much better/much worse) than I would know how to use my calculator.	Measurement Scale of two-item, Much worse/ Much better	Mathieson (1991)	N/A	Not given	Comparing the technology acceptance model with the theory of planned behaviour
	CB (Control Belief) 1: Staying at a green hotel is expensive.	Measurement Scale of 1 to 5, where 5= "Strongly disagree" and 1 = "strongly agree".	Han et al. (2010)	0.603 (Cronbach's alpha – internal consistency)	• Construct validity (confirmatory factor analysis) • Convergent validity (AVE ranging from 0.578 to0.909) • Discriminant validity (AVE was greater than squared correlation between constructs)	Application of the theory of planned behaviour to Green hotel choice: Testing the effect of environmental friendly activities
	CB (Control Belief) 2: finding a green hotel when traveling takes time and effort.					
	CB (Control Belief) 3: Location of a green hotel needs to be convenient.					
	CB (Control Belief) 4: My company/school/others that pays for travel expenses encourage me to stay at a certain hotel.					
	I encounter unanticipated events that place demands on my time.	Measurement Scale of 1 to 5, where 5= "Disagree" and 1 = "Agree".	Chiyangwa (2014)	N/A	• Convergent validity (scale factor analysis and factor loadings)	Belief and actual behaviour in Green Information Technology within a South African tertiary institution of South Africa
	My other classes place heavy demands to print only on one side of the paper.					
	I fail to hibernate the computers or to operate the settings of the computer to lower energy consumption.					
	The university places unanticipated demands on me not to shut down the computers.					
	I am aware of new Green IT regulations being implemented.					

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
	My family obligations place unanticipated demands on the way I conserve energy.					
	Staying at this hotel is expensive.	Measurement Scale of 1 to 7, where 7= "Strongly disagree" and 1 = "Strongly agree".	Han & Kim (2010)	0.814 (Cronbach's alpha – internal consistency)	• Convergent validity (factor loading with constructs, and AVE> 0.50) • Discriminant validity (AVE exceeded squared value of each correlation between constructs)	An investigation of Green hotel customers' decision formation: Developing an extended model of the theory of planned behaviour
	I do not have adequate time to prepare a variety of foods for my child every day.	Measurement Scale of 1 to 5, where 5 = "Extremely likely" and 1= "Extremely unlikely."	Annadurai et al. (2017)	N/A	• Content validity (Expert reviews, and content ratio for total scale (.99))	Assessment of salient beliefs affecting mothers; intention to adherence to dietary diversity in their children's complementary feeding

Table 10: Construct: Behavioural intention

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
Behavioural intention	INT (Intention) 1. I intend to practice green personal computing.	Measurement Scale of 1 to 5, where 5 = "Strongly agree" and 1 = "Strongly disagree".	Chen et al. (2015)	0.821 (Cronbach's alpha – internal consistency)	• Convergent validity (scale factor analysis and factor loadings of higher than 0.70)	Investigating Users' Extrinsic Motivation for Green Personal Computing
	INT (Intention) 2. I will try to practice green personal computing.					
	INT (Intention) 3. I plan to practice green personal computing.					
	INT (Intention) 1. I will intend to practice green computing.	Measurement Scale of 1 to 5, where 5 = "Strongly agree" and 1	Chow & Chen (2009)	0.821 (Cronbach's alpha – internal consistency)	• Convergent validity (scale factor analysis	Intended belief and actual behaviour in Green computing in Hong Kong

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
	INT 2. I will try to practice green computing.	= "Strongly disagree".			and factor loadings of 0.61 above found in all decision variables)	
	INT 3. I will plan to practice green computing.					
	I plan to practise green computing on a regular basis.	Measurement Scale of 1 to 5, where 5 = "Disagree" and 1 = "Agree".	Chiyangwa (2014)	0.706 (Cronbach's alpha – internal consistency)	• Convergent validity (scale factor analysis and factor loadings)	Belief and actual behaviour in Green Information Technology within a South African tertiary institution
	I will make an effort to practise green computing on a regular basis.					
	I intend to practise green computing on a regular basis.					
	I intend to consider Green Information Technology (GIT) when buying a new hardware.	Measurement Scale of 1 to 5, where 5 = "Very much" and 1 = "Very little".	Mishra et al. 2014; Akman & Mishra (2015)	0.870 (Cronbach's alpha – internal consistency)	• Content validity (Items adopted from prior Green IT studies)	Theory of reasoned action application for Green Information Technology acceptance
	I intend to consider GIT when buying a new software.					
	I intend to consider GIT depending on the type of my ICT usage.					
	I intend to consider GIT depending on the place of my ICT usage.					
	VI (Visitor Intention) 1: I am willing to stay at a green hotel when traveling.	Measurement Scale of 1 to 5, where 5= "Strongly disagree" and 1 = "Strongly agree".	Han et al. (2010)	0.65 (Cronbach's alpha – internal consistency)	• Construct validity (confirmatory factor analysis)	Application of the theory of planned behaviour to Green hotel choice: Testing the effect of

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
	VI (Visitor Intention) 2: I plan to stay at a green hotel when traveling.				• Convergent validity (AVE ranging from 0.578 to0.909) • Discriminant validity (AVE was greater than squared correlation between constructs)	environmental friendly activities
	VI (Visitor Intention) 3: I will make an effort to stay at a green hotel when traveling.					

Table 11: Construct: Level of awareness

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
Level of awareness	In general, I believe I am sufficiently aware of environmental issues.	Measurement Scale of 1 to 5, where 5 = "Very much" and 1 = "Very little".	Mishra et al. (2014) Akman & Mishra (2015)	0.829 (Cronbach's alpha – internal consistency)	• Content validity (items adopted from prior Green IT studies)	Green Information Technology
	I believe I am sufficiently aware of the effect of GIT on the environment.	Measurement Scale of 1 to 5, where 5 = "Very much" and 1 = "Very little".				
	I believe I have sufficient awareness of practising GIT.					
	Recycling is a major way to conserves vital natural resources	Measurement Scale of 1 to 7, where 7 = "Strongly agree" and 1 = "Strongly disagree"	Park & Ha (2014)	0.93 (Cronbach's alpha – internal consistency)	• Convergent validity (AVE values greater than 0.5 and factor loadings were greater than 0.70) • Discriminant validity (AVE values were	Understanding consumer recycling: combing the theory of planned behaviour and the norm activation model.
	Recycling is a major way to reduce litter					
	Recycling is a major way to conserves energy					

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
	Recycling is a major way to reduce the wasteful use of land for dumps				greater than squared correlations)	
	TA1. I follow news and developments about the spyware technology.	Measurement Scale of 1 to 5, where 5 = "Completely agree" and 1 = "completely disagree"	Dinev & Hu (2007)	0.85 (Cronbach's alpha – internal consistency)	• Convergent validity (confirmatory factor analysis and factor loadings greater than 0.62) • Discriminant validity	The centrality of awareness in the formation of user behavioural intention toward protective information technologies
	TA2. I discuss with friends and people around me security issues of internet.					
	TA3. I read about the problems of malicious software intruding internet users' computers.					
	TA4. I seek advice on computer web sites or magazines about anti-spyware products.					
	TA5. I am aware of the spyware problems and consequences.					

Table 12: Construct: Person-related beliefs

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
Person-related	I believe that PC manufacturers are one of the major players who can reduce the overall negative impact of PCs.	Measurement Scale of 1 to 5, where 5= "Very much" and 1 = "Very little".	Mishra et al. (2014)	0.815 (Cronbach's alpha – internal consistency)	• Content validity (items adopted from prior Green IT	Theory of reasoned action application for Green Information Technology acceptance

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
beliefs	I believe that software developers are one of the major players who can reduce the overall negative impact of PCs.				studies)	
	I believe that users are one of the major players who can reduce the overall negative impact of PCs.					
	Green IT belief (GITB) 1. I believe that IT equipment and systems contribute to greenhouse gas emissions	Five-point Likert Scale	Molla et al. (2014)	0.89 (Cronbach's alpha – internal consistency)	• Convergent validity (confirmatory factor analysis) • Discriminant validity (confirmatory factor analysis)	Green IT beliefs and pro-environmental IT practices among IT professionals
	GITB 2. I believe that IT management should be responsible for reducing IT's greenhouse gas emissions.					
	GITB 3. I believe that IT can be used to reduce a business's total carbon footprint.					
	GITB 4. I believe that IT professionals can play significant roles in helping businesses tackle their carbon footprint					
	GITB 5. I believe that tackling the carbon footprint of IT systems should be a core part of a green business strategy.					

Table 13: Construct: Behaviour

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature

Construct Name	Measurement Item from Literature	Measurement Scale used in the Literature	Literature Reference for Item	Reliability Measure used in the Literature	Validity measure used in the literature	Research Topic from the Literature
Behaviour	I practice GIT while using ICT.	Measurement Scale of 1 to 5, where 5 = "Very much" and 1 = "Very little".	Mishra et al. (2014); Akman & Mishra 2014; Akman & Mishra (2015)	N/A	• Content validity (items adopted from prior Green IT studies)	Green Information Technology
	I currently practise green computing on a regular basis.	Measurement Scale of 1 to 5, where 5 = "Disagree" and 1 = "Agree".	Chiyangwa (2014)	N/A	• Convergent validity (scale factor analysis and factor loadings)	Belief and actual behaviour in Green Information Technology within a South African tertiary institution
	In the past, I practised green computing on a regular basis.					
	In the course of the past 4 weeks how often have you participated in active sport and/or vigorous physical activity for 20 minutes at a time	Measurement Scale of 1 to 7, where 7 = "Everyday" and 1 = "Almost never"	Ries, Hein, Pihu, & Armenta(2012)	N/A	• Convergent validity (confirmatory factor analysis)	Self-identity of the theory of planned behaviour in predicting physical activity
	I engaged in active sports and or vigorous physical activity for 20 minutes at a time with the following regularity	Measurement Scale of 1 to 7, where 7 = "Never" and 1= "Every day"				
	I do not use paper and/or plastic shopping bags in all possible ways	Measurement Scale of 1 to 5, where 5 = "Strongly agree" and 1 = "Strongly disagree"	Khare (2015)	0.776 (Cronbach's alpha – internal consistency)	• Convergent analysis (exploratory factor analysis)	Antecedents to Green buying behaviour: A study on consumers in an emerging economy
	I usually prefer to purchase reusable products					
	If I have to buy batteries, I always purchase batteries with no mercury or rechargeable ones					
	I try to purchase products with little and/or no environmental harmful, even though they are more expensive.					
	I always purchase bio-degradable products when they are disposed.					
	I always refrain from purchasing disposable products.					

3.6.3 Selected measurement items for the study (prior to the pilot studies)

Tables 4 to 13 provide an extensive base from which to develop an appropriate set of measurement items that are representative of each construct and aligned to the objectives of the study. The approach followed was to adapt the wording of the six most relevant items of each construct from its corresponding table in the previous sub-section. The wording of each item selected was changed as little as possible to retain the original validity of the item while still ensuring that it was relevant to the study.

Importantly, since the study has an original focus on the teaching of Green IT, there were no previously developed questionnaire or construct measurement items available in the literature to fit the study's focus exactly. Therefore, the study had to develop a new, appropriate instrument. The study, appropriately referred to closely related Green IT studies first that used instruments testing the same constructs, although these studies had a different focus and the wording of the items in these instruments did not refer to Green IT teaching, but instead mostly to Green IT usage or adoption or similar.

The number of items to include for measuring each construct was guided by the literature. The maximum number of items was six in all the relevant literature used to source applicable items (Chow & Chen, 2009; Chen et al., 2015; Choon et al., 2014; Mishra et al., 2014; Mancha et al., 2014; Greaves et al., 2013; Lwin & Williams, 2004; Akman & Mishra, 2014; Annadurai, Danasekaran, & Mani, 2017; Han et al., 2010; Dinev & Hu, 2007; Molla et al., 2014; Akman & Mishra, 2015; Khare, 2015). So, guided by the literature, the study began with six items per construct. Subsequently, the study conducted two pilot studies and, based on the resulting SPSS outputs and consultations with the statistician, two items were removed from each construct in the final questionnaire, which resulted in four highly reliable items per construct, as presented in Section "4.4 Reliability".

The decision process about which six items to select from the instruments in the relevant literature (Tables 4-13) was based on the judgement of the researcher, supervisor and a professional statistician and guided by careful consideration of the best fit to the study's particular focus. Then, the wording of the items selected was adapted, where necessary, to reflect Green IT teaching.

Importantly, the scale validity and reliability figures given in Tables 4 to 13 are very relevant to justify the inclusion of that scale into the study. It would not be appropriate to include a scale into the study that had not reported acceptable validity and reliability figures. Of course, once an item is removed from a scale and mixed with items taken from another scale the previous validity and reliability figures do not apply to the new, mixed scale and the new,

mixed scale has to be tested again, and this is what was done in the study. Once the study had developed the new, mixed scales to measure each construct, the study conducted two pilot studies resulting in highly reliable items per construct, as presented in Section "4.4 Reliability".

In addition, the new, mixed scales were subjected to validity measurements in the form of exploratory factor analysis (EFA) in Section "4.5 Exploratory factor analysis (EFA)", which provided an indication that the questionnaire items measured the intended constructs, which is support for construct validity. Furthermore, the rotated matrix with factor loadings suggested that the questionnaire items made sense or had face validity. Also, the rotated matrix with factor loadings indicated that there were no cross-loadings and mostly high loadings, which presented support for discriminant and convergent validity, respectively. These results are provided in Chapter Four, appropriately, because they are based and involve extensive data analyses and discussions, not suited to Chapter Three. Furthermore, all items are formulated as reflective indicators for each construct. The selected measurement items for each construct in the study's research model are presented in Table 14.

Table 14: Selected measurement items for each construct in the study's research model (prior to the pilot studies)

Construct	Selected Measurement Items	Measurement Scale
Attitude toward behaviour "The degree to which performance of the behaviour is positively or negatively valued" (Ajzen, n.d.).	Teaching Green IT is good.	Five-point Likert measurement scale from 1 to 5, where 1= "strongly disagree", 2= "disagree", 3= "neither disagree nor agree", 4= "agree" and 5= "strongly agree". The higher the aggregate value, the more the respondent values teaching Green IT.
	Teaching Green IT is unnecessary. (Negative item)	
	Teaching Green IT is beneficial to my students.	
	Teaching Green IT on a regular basis is important.	
	Teaching Green IT is worthless to me. (Negative item)	
	Teaching Green IT is valuable.	
Subjective Norm "The perceived social pressure to engage or not to engage in a behaviour" (Ajzen, n.d.).	People who are important to me require me to teach Green IT.	Five-point Likert measurement scale from 1 to 5, where 1= "strongly disagree", 2= "disagree", 3= "neither disagree nor agree", 4= "agree" and 5= "strongly agree". The higher the aggregate value, the more pressure the respondent feels from others to teach Green IT.
	Many people compel me to teach Green IT.	
	Most people who are important to me do not expect me to teach Green IT. (Negative item)	
	I am requested to teach Green IT.	
	People whose opinion I value do not ask me to teach Green IT. (Negative item)	
	People whose opinion I value advise me to teach Green IT.	
Perceived behavioural control "Refers to people's perceptions of their ability to perform a given behaviour"	I have the resources, knowledge and skills to teach Green IT.	Five-point Likert measurement scale from 1 to 5, where 1= "strongly disagree", 2= "disagree", 3= "neither disagree nor agree", 4= "agree" and 5= "strongly agree". The higher the aggregate value, the more
	I am confident that if I want to, I could teach Green IT.	
	Teaching Green IT is difficult. (Negative item)	
	I could definitely teach Green IT.	
	I am unsure exactly how to teach Green IT. (Negative item)	

Construct	Selected Measurement Items	Measurement Scale
(Ajzen, n.d.) .	I do not see any problems teaching Green IT.	confident the respondent feels about teaching Green IT.
Behavioural beliefs "The subjective probability that the behaviour will produce a given outcome" (Ajzen, n.d.).	I believe that teaching Green IT helps to reduce the consumption of energy.	Five-point Likert measurement scale from 1 to 5, where 1= "strongly disagree", 2= "disagree", 3= "neither disagree nor agree", 4= "agree" and 5= "strongly agree". The higher the aggregate value, the more the respondent believes that teaching Green IT has positive consequences.
	I believe that teaching Green IT assists to decrease greenhouse gas emissions.	
	I believe that teaching Green IT protects the environment.	
	I believe that teaching Green IT does not improve the planet. (Negative item)	
	I believe that teaching Green IT enables people to create a healthy environment	
	I believe that teaching Green IT does not improve environmental practices. (Negative item)	
Normative beliefs "Refer to the perceived behavioural expectations of such important referent individuals or groups as the person's spouse, family, friends" (Ajzen, n.d.).	I believe that education employers appreciate Green IT teaching.	Five-point Likert measurement scale from 1 to 5, where 1= "strongly disagree", 2= "disagree", 3= "neither disagree nor agree", 4= "agree" and 5= "strongly agree". The higher the aggregate value, the more the respondent believes that others expect him/her to teach Green IT.
	I believe that my friends respect Green IT teaching.	
	I believe that colleagues do not care about Green IT teaching. (Negative item)	
	I believe that most education professionals expect Green IT teaching.	
	In general, I believe that schools/colleges/universities require Green IT teaching.	
	I believe that people in my household do not care about Green IT teaching. (Negative item)	
Control beliefs "Have to do with the perceived presence of factors that may facilitate or impede performance of a behaviour" (Ajzen, n.d.).	I believe that only I determine whether I teach Green IT.	Five-point Likert measurement scale from 1 to 5, where 1= "strongly disagree", 2= "disagree", 3= "neither disagree nor agree", 4= "agree" and 5= "strongly agree". The higher the aggregate value, the more the respondent believes that it is in his/her control to teach Green IT.
	I believe that other people determine whether I teach Green IT. (Negative item)	
	I believe that unanticipated events determine whether I teach Green IT. (Negative item)	
	I believe that educational institutions determine whether I teach Green IT. (Negative item)	
	I believe that environmental regulations determine whether I teach Green IT. (Negative item)	
	I believe that I am in control of whether I teach Green IT.	
Behavioural intention "An indication of a person's readiness to perform a given behaviour" (Ajzen, n.d.).	I intend to teach Green IT.	Five-point Likert measurement scale from 1 to 5, where 1= "strongly disagree", 2= "disagree", 3= "neither disagree nor agree", 4= "agree" and 5= "strongly agree". The higher the aggregate value, the more the respondent intends to teach Green IT.
	I aim to teach Green IT.	
	I am determined to teach Green IT.	
	I plan to teach Green IT.	
	I am not willing to teach Green IT. (Negative item)	
	I do not want to incorporate Green IT into relevant parts of my teaching. (Negative item)	
Level of awareness Refers to	I have sufficient knowledge of Green IT.	Five-point Likert measurement scale from 1 to 5, where 1= "strongly disagree",
	I still have lots to learn about Green IT. (Negative item)	

Construct	Selected Measurement Items	Measurement Scale
having knowledge or showing perception of a fact, situation or phenomenon (Abbate, 2015).	I often inform friends and colleagues about Green IT developments.	2= "disagree", 3= "neither disagree nor agree", 4= "agree" and 5= "strongly agree". The higher the aggregate value, the more awareness and knowledge the respondent has about Green IT.
	People come to be for advice about Green IT best practices.	
	Green IT can be confusing. (Negative item)	
	I am up to date with the latest Green IT trends and issues.	
Person-related beliefs "perceptions about the role of" Mishra, Akman, & Mishra, 2014, p. 33) student teachers in terms of Green IT.	I believe that student teachers have a major role to play in helping others reduce the negative impact of electronic waste on the environment.	Five-point Likert measurement scale from 1 to 5, where 1= "strongly disagree", 2= "disagree", 3= "neither disagree nor agree", 4= "agree" and 5= "strongly agree". The higher the aggregate value, the more the respondent believes that student teachers are important for advancing the Green IT practices of others.
	I believe that student teachers have a major role to play in informing others about how to reduce IT's greenhouse gas emissions.	
	I believe that student teachers are significant role players in advising others about how to reduce the negative impact of IT on the environment.	
	I believe that student teachers have no role to play in training others about how to reduce IT's carbon footprint. (Negative item)	
	I believe that student teachers are vital for preparing others to reduce IT's negative environmental impact.	
	I believe that student teachers do not have an important role to play in advancing the Green IT practice of others. (Negative item)	
Behaviour "The manifest, observable response in a given situation with respect to a given target" (Ajzen, n.d.).	I teach Green IT.	Five-point Likert measurement scale from 1 to 5, where 1= "strongly disagree", 2= "disagree", 3= "neither disagree nor agree", 4= "agree" and 5= "strongly agree". The higher the aggregate value, the more the respondent teaches Green IT.
	I teach Green IT when there is time.	
	I do not teach Green IT. (Negative item)	
	I engage in teaching Green IT at designated times.	
	I always teach Green IT when I can.	
	I teach subjects except Green IT. (Negative item)	

3.7 Bias – types and mitigation

Bias occurs when researchers show partiality and inadequate objectivity in research (Given, 2008; Payne & Payne, 2004). Bias also occurs when a researcher exercises unjustified personal judgement in research, such as decisions that involve favouritism, poor reporting, poor interpretation of data and not collecting data from all the participants that are part of the sample (Payne & Payne, 2004). In addition, bias occurs when a researcher does not report important findings (Given, 2008) or a questionnaire is poorly designed (Winter, 2010). A participant can contribute to bias by not responding truthfully and/or completely to a questionnaire (Vogt, 2005). Bias is risky because it can threaten the ability of researchers to reach legitimate inferences about whether one variable influences a second variable and it can also make it difficult to generalise the results to a broader population (Kovera, 2012). Each

type of bias has a different term, namely sampling bias, selection bias, acquiescence bias and non-response bias (Kovera, 2012; Holbrook, 2008). Each of these terms and their mitigation is explained in the following paragraphs.

Sampling bias occurs when the population is not properly represented by the sample (McCutcheon, 2008; Blankenship, 2010). Sampling bias affects both quantitative and qualitative research (Blankenship, 2010) and may lead to inaccurate findings (Salazar, Crosby, & DiClemente, 2015) which may therefore not be generalizable to the broader population (Salazar et al., 2015). Sampling bias is minimised by choosing the correct sampling techniques (Salazar et al., 2015) and having a sample size large enough (Blankenship, 2010). In this study, sampling bias was mitigated by following advice provided in the literature, which recommends proceeding with a purposive sample (Tongco, 2007; Polit & Beck, 2010) that is representative of the main categories of student teachers to which the research problem relates and enables the research problem to be addressed (Grinnell & Unrau, 2008).

Selection bias occurs when there are logical differences in the characteristics of the subjects in the sample and those who are not part of the sample (Aschengrau & Seage, 2013). Often, selection bias is caused by the techniques used to select participants which then gives inconsistent results (Aschengrau & Seage, 2013). Selection bias is a problem because inferences about that population based on the selected sample are inaccurate (Boehmke, 2003). Selection bias is associated with purposive sampling (Andale, 2017). Since this study uses purposive sampling as discussed in Section 3.5.1, the results of the study were not generalizable beyond the sample of the study. In order to mitigate the selection bias, it is recommended that clear criteria should be used for selecting participants (Houser, 2016). Thus, the criteria used for selecting participants in this study was student teachers from teacher-training institutions in the African country of Swaziland, covering all education teaching grade ranges and qualification types and exhibiting a wide range of demographic characteristics. Specifically, the sample consisted of student teachers from the following teacher training institutions in Swaziland: [***names removed to maintain participant anonymity***]. The sample of the study was considered representative because it represented all education teaching grade ranges and qualification types for student teachers in Swaziland. Specifically, the teaching grade ranges covered were early childhood, primary and secondary education and the qualification types covered were the diplomas and bachelor's degree.

Acquiescence bias occurs when survey respondents concur with questionnaire items or statements irrespective of their meaning (Holbrook, 2008; Weisberg, 2009; Garrett, 2010). Acquiescence bias could affect any questionnaire or interview item in which the response

choices include confirming a statement, but it may be especially tricky with agree-disagree statements (Garrett, 2010; Holbrook, 2008). In order to avoid acquiescence bias, this study included several items that measure each construct of interest (Holbrook, 2008).

Non-response bias occurs when respondents choose not to respond altogether or to respond to particular questions only and those non-responders are different in some way from those who do respond (Vogt, 2005). Two types of non-response bias include unit non-response and item non-response (Daniel, 2011). Unit non-response happens when a researcher fails to gather data from sampled respondents, usually as a result of inability to contact the sampled respondents (Daniel, 2011). Item non-response bias happens when a researcher fails to get data on an item for which information is sought, usually as a result of mistakes, refusal to respond and an inability to respond (Daniel, 2011). Non-response bias can be mitigated by explaining the purpose and importance of the research to respondents before they complete a questionnaire (Boslaugh, 2008; Fink, 2012).

3.8 Research quality and rigour – quantitative procedures and measures

3.8.1 Reliability

In quantitative research, an important indicator of research quality is reliability, which relates to degree to which different researchers get comparative results utilising similar techniques (Given, 2008). A common way to measure reliability in quantitative research is internal consistency (Newman & Benz, 1998). Internal consistency is a measure of consistency between the different items that measure the same construct (Bhattacherjee, 2012). Internal consistency measures the extent to which different respondents rate a multiple-item construct in a similar manner (Bhattacherjee, 2012). Internal consistency is an efficient type of reliability to calculate compared with test-retest reliability.

In this study, the Cronbach's alpha was used to assess the internal consistency between the different items that measured each construct. This study used a questionnaire that consisted of items adapted from previous Green IT and related studies. These items from the literature are shown in Tables 4 to 13 with their corresponding alpha-values for their multi-item constructs. In Table 4 to 13, the vast majority of Cronbach's alpha values, where available, were equal to and greater than 0.70. Hence, these items were considered reliable and acceptable for a research study (Brummans, 2006). Where the literature did not provide the Cronbach's alpha value for an item or in the two cases where they were between 0.60 and 0.70, these items were adapted carefully and after much consideration in relation to the items with published reliability values greater than 0.70.

3.8.2 Validity

Another important indicator of research quality is validity. Validity often refers to construct validity, which is the extent to which a measure adequately represents the underlying construct that it is intended to measure (Muijs, 2004; Bhattacherjee, 2012). However, there are different types of validity, namely face validity, construct validity, content validity and external validity (Crammer & Howitt, 2004; Bhattacherjee, 2012).

Face validity is the extent to which a measure appears to be measuring what it is supposed to measure (Crammer & Howitt, 2004). Face validity asks respondents whether the instrument or test looks valid to them (Muijs, 2004). In this study, the research instrument was given to the respondents to check it for face validity during the pilot study. In addition, questionnaire items were generated from different sources as suggested by Rattray and Jones (2007) and Bowling (2014). In order to establish face validity, the questionnaire items of the study were adapted from research instruments already validated.

Construct validity comprises convergent validity and discriminant validity (Dwivedi, Lal, Williams, Schneberger, & Wade, 2009). Construct validity refers to the degree to which inferences can be legitimately made from the operationalised theoretical constructs (Mathison, 2005). Simplistically, construct validity is about naming something accurately (Mathison, 2005). Methods of establishing construct validity include correlating test scores with scores on measures that do and do not measure the same trait, conducting factor analysis, determining if changes in test scores reflect expected developmental changes and seeing if experimental manipulations have the expected impact on test scores (Mathison, 2005). In particular, convergent validity is the extent to which a measure is related to other measures, which have been designed to measure the same construct (Crammer & Howitt, 2004). For example, a measure of the construct called “anxiety” should be related to other measures of the same construct. In contrast, discriminant validity is the extent to which a measure is unrelated to other measures (Crammer & Howitt, 2004). For instance, a measure of the construct called “self-efficacy” should be unrelated to other measures of a dissimilar construct, such as “locus of control” (Matthews & Kostelis, 2011). Importantly, this study adapted items to measure the constructs from previous Green IT and related studies that have been validated as indicated in Tables 4 to 13. This practice promotes construct, convergent and discriminant validity.

Content validity refers to whether or not the content of a measuring instrument is representative (Krishnaswamy, Sivakumar, & Mathirajan, 2009). A research instrument that has content validity provides enough coverage of the subject under study (Krishnaswamy et al., 2009). In addition, content validity refers to whether or not the content of the items of the

questionnaire measure accurately the construct to be measured (Muijs, 2004). A measure may be said to have content validity when its items accurately represent those being measured (Vogt, 2005). An example of a content-valid testing measure would be to use a word processing test (e.g., speed, accuracy) to evaluate job seekers for a secretarial job (Wash, 2015). The word processing test is representative of the content of the job in terms of behaviour and skills. Content validity is not a statistical property; it is a matter of expert judgement (Vogt, 2005). In order to ensure content validity, researchers sometimes use items from different research instruments that assess the same constructs (Comer & Kendall, 2013). This study has also used items from different and applicable research instruments that measure the same set of constructs to provide sufficient coverage of the constructs for content validity.

External validity refers to whether the results of a study are generalizable to the population that the sample was taken from or to other similar populations (Lavrakas, 2008). External validity seeks to address generalisability of results and findings of a study (Dubey, 2006). This study used purposive sampling which has an impact on external validity. Thus, inferences and conclusions drawn from the study may not be applied beyond the sample. Nevertheless, any study conducted using purposive sampling can be argued to exhibit external validity on the sample and a study conducted using purposive sampling contributes to theory because it can be replicated for confirmation in broader populations (Tongco, 2007).

3.8.3 Pilot Study

Testing is an important stage in research instrument development and often involves conducting a pilot study (Robins, Fraley, & Krueger, 2007). Pilot studies are often used to test the items in a questionnaire (Rattray & Jones, 2007). Furthermore, a pilot study is a means of checking whether a survey can be administered and provide accurate data (van Teijlingen & Hundley, 2004). Specifically, the pilot study assists to refine the wording and content of questionnaire items (Rattray & Jones, 2007) and to determine whether the length of the questions is appropriate or not and to identify ambiguous items (Greaves et al., 2013; Rattray & Jones, 2007). The literature suggests that participants for a pilot study should come from the same group participating in the main study (Brink & Wood, 1998) and it is conducted with a small group of respondents (Isaac & Michael, 1995; Hill, 1998; Rattray & Jones, 2007).

In addition, reliability analysis can be conducted on the pilot data in the study, which involves calculating the Cronbach's alpha (Rattray & Jones, 2007; Andrew, Pedersen, & McEvoy, 2011). The values of Cronbach's alpha range from zero to one (Andrew, Pedersen, &

McEvoy, 2011). Questionnaire items are considered reliable when the value of Cronbach's alpha approaches one (Nunnally, 1978). Often, a value of 0.70 or more is considered acceptable and a value of 0.90 to 0.95 is recommended where very high risk decisions have to be taken (Nunnally, 1978). In this study, Cronbach's alpha was calculated using the statistical software package called Statistical Package for the Social Sciences (SPSS).

After obtaining ethical clearance from the Unisa School of Computing, two pilot studies were conducted with student teachers that were representative of the respondents for the main study. The reason for the second pilot study was due to the relatively low Cronbach alpha values obtained from the first pilot study. In the first pilot study, 20 students participated. Table 15 shows the results of the first pilot study.

Table 15: Pilot Study One reliability analysis results

Construct	**Cronbach Alpha**
Attitude toward behaviour (ATB)	0.482
Subjective norm (SN)	0.490
Perceived behavioural control (PBC)	0.725
Behavioural beliefs (BB)	0.553
Normative beliefs (NB)	0.464
Control beliefs (CB)	0.688
Behavioural intention (BI)	0.827
Level of awareness (LA)	0.464
Person-related beliefs (PRB)	0.570
Behaviour (B)	0.757

The Cronbach alpha values for attitude toward behaviour (0.482), subjective norm (0.490), behavioural beliefs (0.55), normative beliefs (4.64), control beliefs (0.688), level of awareness (0.464) and person related beliefs (0.570) were below the recommended value of 0.7 (Nunnally, 1978). Subsequently, several questionnaire items were refined and/or reworded and/or removed, especially based on the SPSS "Item-Total Statistics" report that shows what the Cronbach's alpha would be if an item was deleted. Consequently, the number of items per construct was reduced from six per construct to five per construct.

A second pilot study was then conducted with fifteen student teachers. Table 16 shows the reliability analysis results of the second pilot study. The Cronbach alpha values for Attitude toward behaviour (0.327), Behavioural beliefs (0.155), Normative beliefs (0.694), Behavioural intention (0.546), Person-related beliefs (0.199) and behaviour (0.376) were still below 0.7. Again, several questionnaire items were refined and/or reworded and/or removed, especially based on the SPSS "Item-Total Statistics" report that shows what the Cronbach's alpha would be if an item was deleted. The report indicated that many of the negatively

phrased questions should be removed. This, in addition to advice from the literature that provided evidence that negative items or questions tend to minimise a questionnaire's validity when used to counteract acquiescence bias (Schriesheim & Hill, 1981), misrepresent attitudes (Barnette, 2000; Johnsom, Bristow, & Schnieder, 2004; Schriesheim & Eisenbach, 1995) and usually lower the Cronbach alpha as the items show poor correlations with a summated score (Roszkowski & Soven, 2010), resulted in the negatively worded questionnaire items being removed from each of the constructs. The result was a reduction of five items per construct to four items per construct. The final items and questionnaire is provided in Appendix C.

Table 16: Pilot Study Two reliability analysis results

Construct	**Cronbach Alpha**
Attitude toward behaviour (ATB)	0.327
Subjective norm (SN)	0.740
Perceived behavioural control (PBC)	0.827
Behavioural beliefs (BB)	0.155
Normative beliefs (NB)	0.694
Control beliefs (CB)	0.926
Behavioural intention (BI)	0.546
Level of awareness (LA)	0.714
Person-related beliefs (PRB)	0.199
Behaviour (B)	0.376

3.9 Research ethics

Ethical clearance was required from the University of South Africa (Unisa) in order to carry out the research. The ethical clearance required permission firstly from each teacher-training institutions participating in the study. Permission letters were obtained from each teacher-training institution and are provided in Appendix D. In addition, a permission letter was obtained from the government of the Kingdom of Swaziland Ministry of Education and Training, also provided in Appendix D. Moreover, ethical clearance was applied for and obtained from the Unisa School of Computing. The signed ethical clearance from the Unisa School of Computing is provided in Appendix E with ethics clearance reference number 099/RND/2017/CSET_SOC. Furthermore, each individual respondent was requested to provide informed consent as part of the questionnaire. To cater for confidentiality and anonymity, respondents' names were not part of the data collection, analysis, findings, reporting or publications, respondents' participation was voluntary and respondents were allowed to withdraw from the study any time before submitting their anonymous questionnaire responses. In addition, pseudonyms of the institutions of the teacher-training institutions were used in the study's subsequent publications. After collecting data, the

questionnaire data were safely stored according to the Unisa ethics clearance data storage protocols.

3.10 Data analysis-principles and processes

In order to address the research problem, answer the research questions and achieve the research objective, the main data analysis in the study should be able to test hypotheses, establish association between constructs and evaluate the research model. Structural equation modeling (SEM) meets these requirements. Specifically, SEM uses hierarchical structural equations to express difficult variable associations and measures relationships among multiple variables or constructs simultaneously (Gefen et al., 2000). In addition, SEM involves confirmatory factor analysis (Chow & Chen, 2009; Gefen, Straub, & Boureau, 2000) and multivariate analysis techniques that are used for inspecting and evaluating measurement models (Chow & Chen, 2009). The advantages of SEM over other regression tools, which are also used for multivariate analysis, include that SEM can evaluate a structural model, establish association between independent and dependent constructs, assess a measurement model with latent variables, test hypotheses and perform factor analysis within the same analysis process (Gefen et al., 2000).

SEM consists of a measurement model and a structural model (Schumacker & Lomax, 2010; Byrne, 2016). The measurement model is a confirmatory model and is used to depict relationships between latent variables and the observed variables (Schumacker & Lomax, 2010; Schumacher & Lomax, 2016). The measurement model is defined prior to specifying the structural model to ensure that all latent variables are measured correctly (Schumacker & Lomax, 2010). The structural model is used to specify the relationships among the latent variables (Schumacker & Lomax, 2010).

3.11 Chapter summary and conclusions

Chapter Three presented the study's research methodology. Chapter Three was guided by the study's research problem and research objective, which is to investigate the antecedents to teaching Green IT in an African country context, in order to understand how to improve student teachers' intention to teach Green IT and consequently their actual behaviour of teaching Green IT.

Chapter Three achieved the following specified objectives, detailing and justifying the research strategy with reference to the study's research problem and objective, substantiating the sampling and data collection methods, developing the data collection instrument, explaining how bias is mitigated, detailing how research quality and rigour are incorporated

and presenting the data analysis method. Thus, Chapter Three achieved its goal, which was to define and justify the research methodology for answering research question two.

In conclusion, the research philosophy, methodological choice and research strategy were consistent and appropriate for measuring, testing and validating the study's hypotheses in order to address the study's research problem and objective. In addition, the development of the research instrument was explained and substantiated, which provides guidance for other researchers developing similar research instruments. Also, a useful data analysis technique, SEM, was elaborated upon to inform other researcher of its uses, benefits and limitations.

This chapter has value for academics since it details an appropriate methodology for measuring the research model and provides the reasons for each methodological choice to support the claim of relevance and rigour. This chapter also has value for teaching practice by explaining an appropriate way of gathering evidence to inform teaching and curriculum design, specifically, it provides curriculum guidance to promote environmental sustainability in general and Green IT in particular. Chapter Four follows Chapter Three and is the presentation and discussion of the research data.

Chapter 4: Presentation, Analysis and Discussion of the Data

4.1 Chapter introduction

The previous chapter, Chapter Three, defined and justified the research methodology. Chapter Four reports on the implementation of the research methodology explained in Chapter Three. The goal of Chapter Four is to present, analyse and discuss the data gathered and answer research question two. To achieve this goal, Chapter Four has the following specific objectives: reporting on the data collection and handling processes, measuring reliability and validity, examining the underlying dimensionality of the questionnaire items, describing the demographics of the respondents, analysing the effects of the demographic variables, testing the study's hypotheses and evaluating the research model.

Chapter Four continues by providing a detailed account of the data collection and data handling processes, describing the respondents' demographics, presenting the research process, detailing the characteristics of the respondents, analysing the effects of the demographic variables, measuring the reliability of the research instrument, examining the underlying dimensionality and validity of the questionnaire items using exploratory factor analysis (EFA) and testing the study's hypotheses and evaluating the research model using structural equation modeling (SEM).

4.2 Data collection

Data collection for the main study started on the 4th of April 2018 and ended on the 20th April 2018. Data were collected from [***names removed to maintain participant anonymity***] as explained and justified in Section 3.5. Importantly, respondents who took part in any of the two pilot studies were excluded from the main study. In total, three hundred student teachers completed the online survey, which was administered by the researcher using Google Forms.

Following signed permission letters from each of the teacher-training institutions and the government of the Kingdom of Swaziland Ministry of Education and Training (Appendix D) and ethical clearance from the Unisa School of Computing (Appendix E), the lecturers of the classes of the prospective respondents were first approached and consulted about their students' participation. The importance and purpose of the study was explained to both lecturers and students, including that participating in the study was voluntary, they were under no obligation to participate in the study, they were allowed to withdraw from the study any time before submitting their anonymous questionnaire responses and their names would not be part of the data collection, analysis, findings, reporting or publications.

Selected respondents were requested to complete the anonymous online survey at the computer laboratories in each of the teacher-training institutions. Respondents were first required to read carefully the front cover letter to the online anonymous web-based survey (Appendix C), which explained the purpose and importance of the study and the informed consent principles. An "ok" button was provided on the online survey that was required before a respondent could access the questionnaire and indicated that the respondent had given his/her informed consent based on the principles explained on the front cover letter to the online anonymous web-based survey. The online survey had two sections. Section A required respondents to fill in their demographic information, comprising eight questions. Section B required the student teachers to give their opinions to the items measuring the study's research model and comprised 40 questions. The data collected were saved in a Microsoft Excel file which is functionality provided by Google Forms.

4.3 Data handling

After data collection, data cleaning was performed. The purpose of data cleaning is to identify and remove errors and inconsistences which are caused by inaccurate entry or corrupted data (Osbone, 2013). Such data is identified and then either replaced or modified or deleted. Data cleaning was done in the Microsoft excel file before it was imported into SPSS.

The only changes that were made to the data were to demographic data items from Section A in the questionnaire, as follows. One response to the gender question was changed, namely "lesbian" was changed to "I do not want to answer this question" because lesbian is not a gender, it is a sexual orientation. Fifty-seven responses to the question "I am ___ years old" were changed, namely all 57 blank responses were changed to "I do not want to answer this question" because the Google Forms questionnaire was set up to record a blank response to represent the actual response of "I do not want to answer this question". This change ensured that the responses were correctly represented in SPSS. Similarly, 58 responses to the question "So far, I have ___ months of practical teaching experience" were changed, namely all 58 blank responses were changed to "I do not want to answer this question" because the Google Forms questionnaire was setup to record a blank response to represent the actual response of "I do not want to answer this question". This change ensured that the responses were correctly represented in SPSS.

Four responses to the question "when I start teaching, I want to teach the following subject category" were changed, namely two responses of "social studies" were changed to "social science" because "social studies" is equivalent to "social science", and the response of "fandamental domains" was changed to "I do not want to answer this question" because even

"fundamental domains" is too vague and "expressive arts" was changed to "arts" because "arts" includes "expressive arts". In addition, where a respondent had entered a valid subject category using the "other" response option on the questionnaire, that valid subject category was added to the list of subject categories instead of recording those responses as "other". This decision provided better information about the respondents. The subject categories that were added as a result of being entered in the "other" option on the questionnaire are agriculture, applied science, consumer science, environmental science, history, numeracy and religious education.

For the question "this year, I am registered for the following qualification", where a respondent had entered a valid qualification using the "other" response option on the questionnaire, that valid qualification was added to the list of qualifications instead of recording those responses as "other". This decision provided better information about the respondents. The qualification that was added as a result of being entered in the "other" option on the questionnaire is bachelor of education in leadership and management. Thereafter, no other changes to the data were required and subsequent data analyses could proceed.

4.4 Reliability

The reliability of the questionnaire items was tested using Cronbach's alpha. The Cronbach alpha was used to assess the internal consistency between the different items that measure each construct in the research model. To improve the reliability of the questionnaire, two pilot studies were conducted, as described in Section 3.8.3. Table 17 shows the Cronbach alpha coefficients for all the constructs in the questionnaire based on the data from the main study. The Cronbach's alpha values are above 0.7 which means that they are considered reliable for the constructs in the questionnaire (Nunnally, 1976).

Table 17: Reliability analysis of the questionnaire items measuring each construct

Construct	**Cronbach Alpha**
Attitude toward behaviour (ATB)	0.741
Subjective norm (SN)	0.833
Perceived behavioural control (PBC)	0.880
Behavioural beliefs (BB)	0.773
Normative beliefs (NB)	0.896
Control beliefs (CB)	0.856
Behavioural intention (BI)	0.904
Level of awareness (LA)	0.903
Person-related beliefs (PRB)	0.886
Behaviour (B)	0.939

4.5 Exploratory factor analysis (EFA)

4.5.1 Introduction

Factor analysis can be categorised into two types, namely exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) (Worthington & Whittaker, 2006). EFA is appropriate when it is believed that one or more latent factors exist and they exert a directional influence on the observed variables (Rourke & Hatcher, 2013; Costello & Osborne, 2009). EFA examines the underlying dimensionality of a set of questionnaire items and can group them into meaningful factors or components (Worthington & Whittaker, 2006). In contrast, CFA assists to establish the relationship between data and a priori identified factors (Reinard, 2006; Pelt, Lackery, & Sullivan, 2003). EFA should be used for new instrument designs and supports cleaner structural equation modeling (SEM). In this study, SEM is conducted instead of CFA alone (Worthington & Whittaker, 2006). In addition, EFA helps to evaluate construct validity (Worthington & Whittaker, 2006), convergent, discriminant and face validity.

4.5.2 Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity

Before proceeding with EFA, it is recommended that a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy be conducted to measure how suited the data is for EFA (Gerber & Hall, 2018). A KMO test is used to measure the correlation structure of the items on which the EFA analysis is based (Gerber & Hall, 2018). The KMO measure ranges from zero to one (Kaiser & Rice, 1974). A KMO value greater than 0.5 shows a strong correlation structure between items and provides good justification to do EFA (Kaiser & Rice, 1974). As per Table 18, the KMO value obtained was 0.847, which implies strong support for conducting EFA.
Bartlett's test of sphericity is another useful test and tests the null hypothesis that the dataset's initial correlation matrix is an identity matrix, where all the diagonal elements are one and all the other elements are zero. As per Table 18, the significance is less than 0.001, so the null hypothesis is rejected to indicate that the dataset's initial correlation matrix is not an identity matrix. Therefore, EFA is appropriate.

Table 18: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of sampling Adequacy		.847
Bartlett's Test of Sphericity	Approx. Chi-square	7571.258
	Df	780
	Sig.	.000

4.5.3 Communalities

Item communalities are important for assessing the factorability of a dataset (Worthington & Whittaker, 2006). Communalities are numerical values used to describe the degree to which the individual items correlate with the other items (Marcoulides & Hershberger, 2014). A communality value close to one is preferable (Gerber & Hall, 2018). Questionnaire items with very low communalities below 0.4 are candidates for removal (Child, 2006). Table 19 shows the communalities for the study's dataset; the extraction column refers to the extracted communalities. All the communalities are above 0.4 which indicates that all the items can be retained.

Table 19: Communalities for the study's dataset

Question	Extraction	Question	Extraction
1	0.572	21	0.548
2	0.642	22	0.764
3	0.559	23	0.791
4	0.586	24	0.780
5	0.635	25	0.803
6	0.662	26	0.810
7	0.734	27	0.796
8	0.718	28	0.733
9	0.741	29	0.780
10	0.831	30	0.785
11	0.732	31	0.820
12	0.702	32	0.774
13	0.497	33	0.793
14	0.717	34	0.748
15	0.707	35	0.787
16	0.547	36	0.704
17	0.740	37	0.845
18	0.771	38	0.864
19	0.761	39	0.861
20	0.778	40	0.837

4.5.4 Extraction and rotation method

Common methods of factor extraction are principal factor axis, principal components, alpha factoring, maximum likelihood, unweighted least squares, image factoring and generalised least squares (Costello & Osborne, 2009; Kremlberg, 2011; Reinard, 2006). Principal components analysis (PCA) was conducted because it is widely used and is a variable-

reduction technique that aims to reduce a large set of variables into a smaller set of principal components that account for most of the variance in the original variables (Costello & Osborne, 2009). Varimax with Kaiser normalization was used for rotating the components since it maximises the variance of each of the components and simplifies interpretation (Costello & Osborne, 2009; Kremlberg, 2011).

4.5.5 Total variance explained, scree plot and rotated matrix with factor loadings

Table 20 shows the total variance explained analysis from SPSS. The main parts are the components, initial eigenvalues, extraction sums of squared loadings and rotation sums of squared loadings. The components column is the number of possible components; if all the questionnaire items were components, which are comparable to factors, then there would be 40. The initial eigenvalues section is the initial analysis of the dataset, before extraction and rotation. The "Initial Eigenvalues" section's first column, called "Total", presents eigenvalues. Eigenvalues signify the amount of variation explained by a component (Gerber & Hall, 2018) and, according to the Kaiser Guttman rule, if an eigenvalue for a factor is one or higher, then that component should be retained (Reinard, 2006). There are 10 eigenvalues that are greater than one, indicating that 10 components should be retained. The "Initial Eigenvalues" section's second column, called "% of Variance", presents the percentage of variance in the dataset that the corresponding component explains. The "Initial Eigenvalues" section's third column, called "Cumulative %", presents the cumulative percentage of variances in the dataset that the components explain. A cumulative percentage of variance more than 60% is considered sufficient (Gerber & Hall, 2018). So, the 10 components explain just over 73% of the variance in the original 40 items.

The "Extraction Sums of Squared Loadings" section shows the extraction of the 10 factors. Based on the extraction method, namely principal components, the values in this section are the same as the values in the "Initial Eigenvalues" section, except that all factors with eigenvalues less than one are omitted. The "Rotation Sums of Squared Loadings" section shows the distribution of the variance after the varimax rotation. The effect is to optimise the factor structure and the result is the 10 factors with comparable variances.

Table 20: Total variance explained

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumula-tive %	Total	% of Variance	Cumula-tive %	Total	% of Variance	Cumula-tive %
1	9.793	24.483	24.483	9.793	24.483	24.483	3.481	8.702	8.702
2	3.614	9.036	33.519	3.614	9.036	33.519	3.196	7.989	16.691

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumula-tive %	Total	% of Variance	Cumula-tive %	Total	% of Variance	Cumula-tive %
3	2.898	7.246	40.765	2.898	7.246	40.765	3.067	7.667	24.358
4	2.340	5.851	46.615	2.340	5.851	46.615	3.049	7.623	31.981
5	2.224	5.560	52.176	2.224	5.560	52.176	3.012	7.531	39.512
6	2.001	5.003	57.178	2.001	5.003	57.178	2.994	7.484	46.996
7	1.843	4.607	61.786	1.843	4.607	61.786	2.858	7.145	54.141
8	1.646	4.114	65.900	1.646	4.114	65.900	2.756	6.890	61.031
9	1.509	3.772	69.672	1.509	3.772	69.672	2.460	6.151	67.182
10	1.385	3.463	73.135	1.385	3.463	73.135	2.381	5.953	73.135
11	.789	1.972	75.107						
12	.740	1.850	76.957						
13	.738	1.845	78.802						
14	.624	1.559	80.361						
15	.617	1.542	81.903						
16	.556	1.391	83.294						
17	.506	1.266	84.560						
18	.504	1.259	85.819						
19	.458	1.145	86.964						
20	.427	1.067	88.031						
21	.393	.983	89.015						
22	.379	.948	89.962						
23	.365	.914	90.876						
24	.332	.829	91.705						
25	.310	.774	92.479						
26	.299	.747	93.226						
27	.295	.738	93.964						
28	.273	.682	94.646						
29	.256	.639	95.285						
30	.245	.612	95.897						
31	.219	.548	96.445						
32	.209	.523	96.968						
33	.196	.489	97.457						
34	.190	.475	97.932						
35	.175	.437	98.369						
36	.147	.368	98.737						
37	.142	.355	99.092						
38	.133	.331	99.424						
39	.125	.313	99.737						
40	.105	.263	100.000						

In addition, a scree plot is useful for analysing factors. It graphs the eigenvalues on the y-axis against each component on the x-axis and the values are the same as those in the "Total" column of the "Initial Eigenvalues" section in the total variance explained analysis table, Table 20. Figure 9 shows the scree plot for the dataset. The curve from the first two components has the steepest decline followed by the next eight components, namely components three to ten. At component 11 there is an inflection point where the curve becomes almost horizontal. This indicates that the components from then on account for less and less of the total variance. Also, the components from component 11 onwards show eigenvalues less than one. Therefore, the decision to retain the first 10 components is supported.

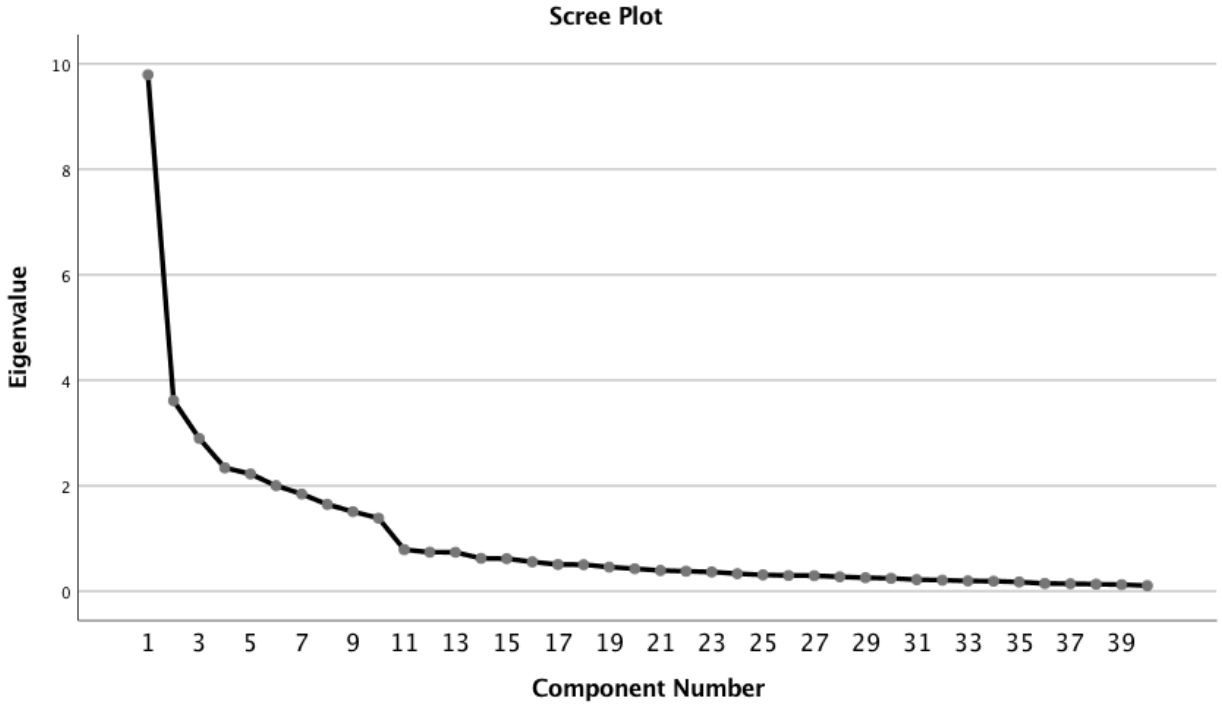

Figure 9: Scree plot

Furthermore, Table 21 shows the rotated matrix with factor loadings. The purpose of factor loadings is to ascertain how the items of a questionnaire load onto the components or factors (Gerber & Hall, 2018). A factor that that has no items that load onto it is usually discarded (Reinard, 2006). A loading of 0.40 or more on a factor can be considered meaningful and a value near one shows that an item loads highly on the factor (Gerber & Hall, 2018). The table demonstrates correspondence to the groupings of the items for each of the 10 constructs in the questionnaire, providing support for the study's research model and the items used to measure each construct. Thus, there is justification to proceed with the subsequent analyses in this chapter, including structural equation modeling (SEM) for analysing the hypothesised

relationships among the 10 constructs in the study's research model and answering the study's research question two.

In addition, the rotated matrix with factor loadings in Table 21 provides an indication that the questionnaire measures the intended constructs, which is further support for construct validity. Furthermore, the rotated matrix with factor loadings suggests that the questionnaire makes sense or has face validity. The rotated matrix with factor loadings indicates that there are no cross-loadings and mostly high loadings, which presents support for discriminant and convergent validity, respectively.

Table 21**:** Rotated matrix with factor loadings

Rotated Component Matrix[a]										
Construct & Item	Component									
	1	2	3	4	5	6	7	8	9	10
Behaviour (B) [39. I lecture Green IT.]	.911									
Behaviour (B) [38. I instruct Green IT.]	.889									
Behaviour (B) [40. I coach Green IT.]	.881									
Behaviour (B) [37. I teach Green IT.]	.872									
Level of awareness (LA) [31. I am aware of Green IT.]		.858								
Level of awareness (LA) [30. I am informed about Green IT.]		.844								
Level of awareness (LA) [29. I know about Green IT.]		.809								
Level of awareness (LA) [32. I have learnt about Green IT.]		.803								
Normative beliefs (NB) [20. I believe that schools would expect me to teach Green IT.]			.786							
Normative beliefs (NB) [17. I believe that school management would expect me to teach Green IT.]			.783							
Normative beliefs (NB) [18. I believe that educators would require me to teach Green IT.]			.782							

Rotated Component Matrix[a]										
Construct & Item	Component									
	1	2	3	4	5	6	7	8	9	10
Normative beliefs (NB) [19. I believe that education professionals would want me to teach Green IT.]			.777							
Person-related beliefs (PRB) [33. I believe that student teachers have a role to play in promoting Green IT practices.]				.865						
Person-related beliefs (PRB) [35. I believe that student teachers have a role to play in progressing Green IT practices.]				.850						
Person-related beliefs (PRB) [34. I believe that student teachers have a role to play in advancing Green IT practices.]				.819						
Person-related beliefs (PRB) [36. I believe that student teachers have a role to play in furthering Green IT practices.]				.747						
Behavioural intention (BI) [27. I plan to teach Green IT.]					.808					
Behavioural intention (BI) [25. I intend to teach Green IT.]					.783					
Behavioural intention (BI) [26. I aim to teach Green IT.]					.776					
Behavioural intention (BI) [28. I strive to teach Green IT.]					.775					
Perceived behavioural control (PBC) [10. I am sure that I can teach Green IT.]						.836				
Perceived behavioural control (PBC) [11. I am certain that I can teach Green IT.]						.809				
Perceived behavioural control (PBC) [9. I am confident that I can teach Green IT.]						.789				
Perceived behavioural control (PBC) [12. I am positive that I can teach Green IT.]						.743				

Rotated Component Matrix[a]										
Construct & Item	Component									
	1	2	3	4	5	6	7	8	9	10
Control beliefs (CB) [23. I believe that I choose whether I teach Green IT.]							.880			
Control beliefs (CB) [24. I believe that I determine whether I teach Green IT.]							.869			
Control beliefs (CB) [22. I believe that I decide whether I teach Green IT.]							.851			
Control beliefs (CB) [21. I believe that I am in control of whether I teach Green IT.]							.712			
Subjective Norm (SN) [7. Most people whose opinions I value would approve of me teaching Green IT.]								.815		
Subjective Norm (SN) [8. Most people whose opinions I value would appreciate me teaching Green IT.]								.806		
Subjective Norm (SN) [5. Most people who are important to me would approve of me teaching Green IT.]								.752		
Subjective Norm (SN) [6. Most people who are important to me would appreciate me teaching Green IT.]								.743		
Behavioural beliefs (BB) [15. I believe that teaching Green IT would help others to decrease pollution.]									.831	
Behavioural beliefs (BB) [14. I believe that teaching Green IT would help others to decrease carbon emissions.]									.828	
Behavioural beliefs (BB) [16. I believe that teaching Green IT would help others to decrease electronic waste.]									.686	

Rotated Component Matrix[a]										
Construct & Item	Component									
	1	2	3	4	5	6	7	8	9	10
Behavioural beliefs (BB) [13. I believe that teaching Green IT would help others to decrease energy consumption.]									.673	
Attitude toward behaviour (ATB) [2. Teaching Green IT is valuable.]										.767
Attitude toward behaviour (ATB) [4. Teaching Green IT is worthwhile.]										.717
Attitude toward behaviour (ATB) [3. Teaching Green IT is useful.]										.712
Attitude toward behaviour (ATB) [1. Teaching Green IT is good.]										.688
Extraction method: Principal components analysis										
a.10 components extracted.										

4.6 Respondent demographics

A total of 300 online survey questionnaires were completed by the student teacher respondents. The demographic information of the respondents is shown in Table 22.

Table 22: Demographic profile of the sample

Questionnaire item	Response option/category	Frequency	Percentage
Gender	Male	124	41.3 %
	Female	174	58.0 %
	I do not want to answer this question	2	0.7 %
	Total	**300**	**100%**
Home language	Swazi	293	97.7%
	English	6	2.0%
	Zulu	1	0.3%
	Total	**300**	**100%**
Age in years	19	3	1%
	20 - 24	87	29%
	25 - 29	83	27.7%
	30 - 34	39	13%
	35 - 39	18	6%
	40 - 44	10	3.3%
	45 +	3	1%

Questionnaire item	Response option/category	Frequency	Percentage
	I do not want to answer this question	57	19.0%
	Total	**300**	**100%**
This year, most of my subjects/modules/courses are	First year subject/modules/courses	57	19.0%
	Second year subject/modules/courses	84	28.0%
	Third year subject/modules/courses	156	52.0%
	I do not want to answer this question	3	1.0%
	Total	**300**	**100%**
When I start teaching, I want to teach the following teaching grade range	Early childhood grades	65	21.7%
	Primary school grades	182	60.7%
	Secondary school grades	48	16%
	I do not want to answer This question	5	1.7%
	Total	**300**	**100%**
When I start teaching, I want to teach the following subject category	Agriculture	9	3%
	Applied Science	6	2%
	Arts	14	4.7%
	Computers	20	6.7%
	Consumer Science	5	1.7%
	Environmental Science	1	0.3%
	History	1	0.3%
	Languages	64	21.3%
	Mathematics	87	29%
	Natural Science	27	9%
	Numeracy	1	0.3%
	Physical Education	7	2.3%
	Religious Education	1	0.3%
	Social Science	42	14%
	Special Education	10	3.3%
	I do not want to answer this question	5	1.7%
	Total	**300**	**100%**
This year, I am registered for the following qualification	Early childhood education diploma	81	27.0%
	Primary teacher's diploma	130	43.3%
	Secondary teacher’s diploma	42	14.0%
	Bachelor of special and inclusive education	42	14.0%
	Bachelor of education in leadership and management	5	1.7%
	Total	**300**	**100%**

Questionnaire item	Response option/category	Frequency	Percentage
Months of practical teaching experience	No practical teaching experience	75	25%
	Up to a year of practical teaching experience	125	41.7%
	1 year to under 2 years of practical teaching experience	15	5%
	2 years to under 3 years of practical teaching experience	4	1.3%
	3 years to under 4 years of practical teaching experience	3	1%
	4 years to under 5 years of practical teaching experience	5	1.7%
	5 years to under 10 years of practical teaching experience	10	3.3%
	10 years and more of practical teaching experience	5	1.7%
	I do not want to answer this question	58	19.3%
	Total	**300**	**100%**

Figure 10 shows the responses by gender. While there were slightly more female respondents (58%) than male respondents (41%) and only two student teachers did not want to answer the gender question, both genders were well-represented.

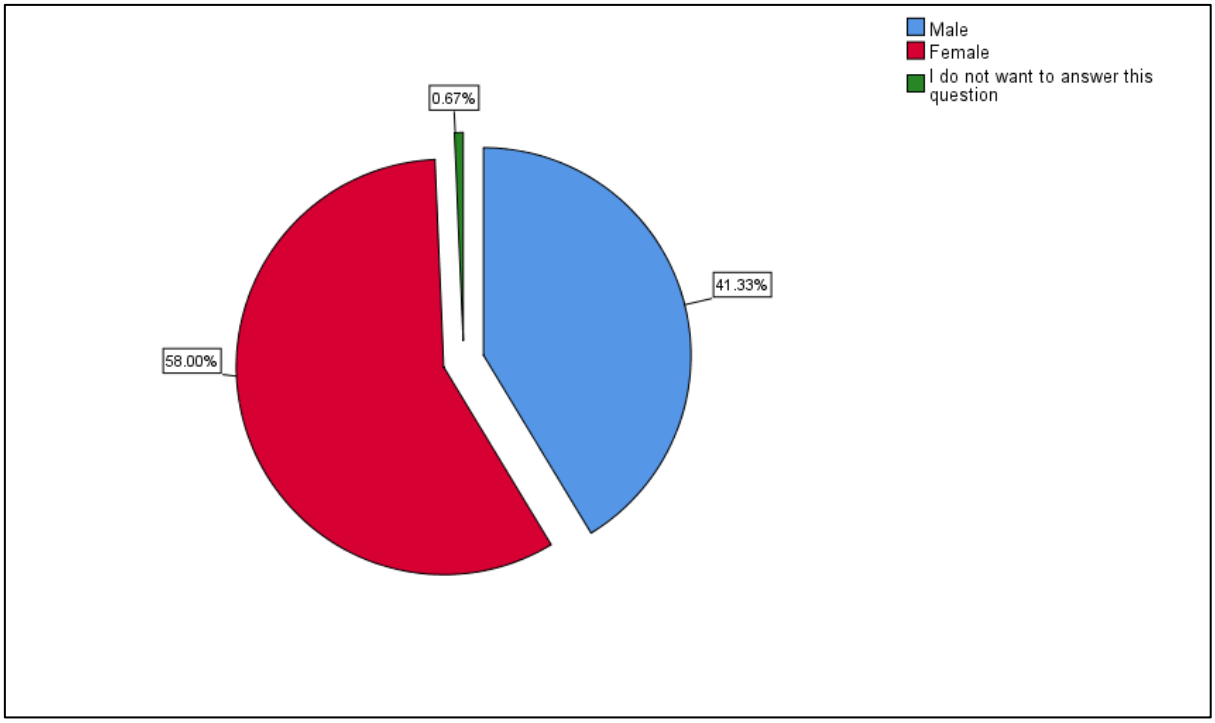

Figure 10: Responses by gender

Figure 11 shows the responses by home language. The most frequent home language was Swazi (97.7%), followed by English (six respondents) and then Zulu (one respondent), which was expected since the study was conducted in Swaziland where Swazi is the main home language.

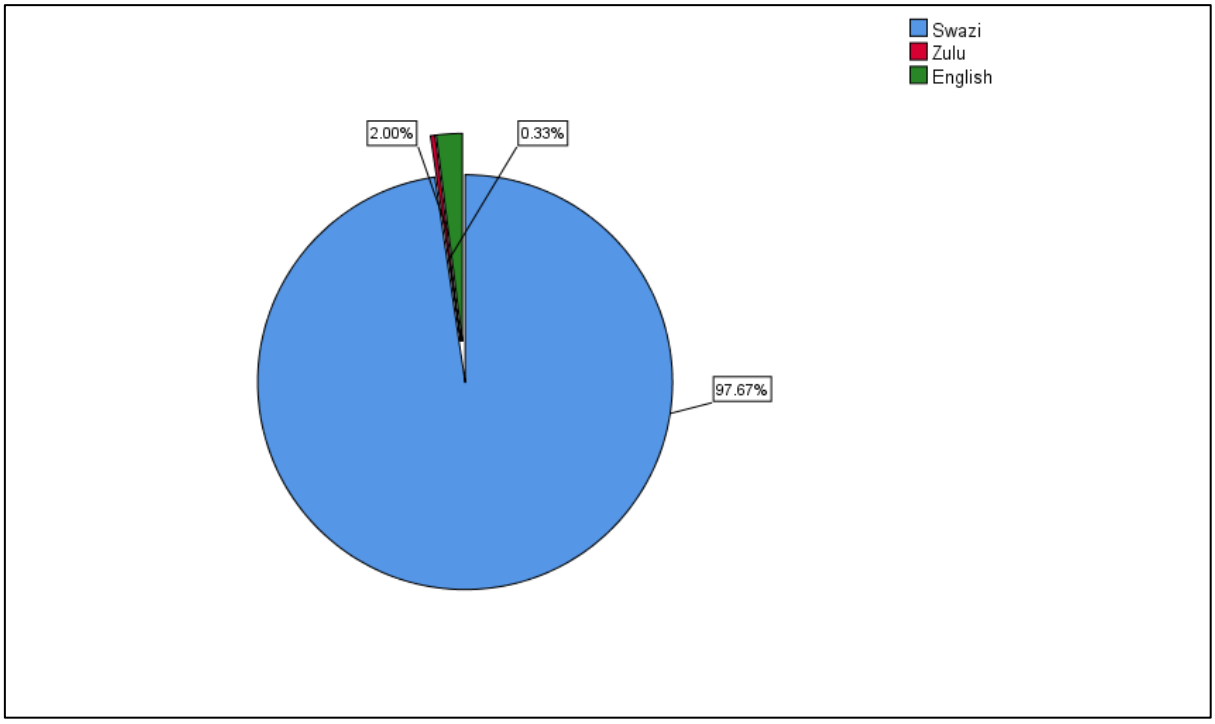

Figure 11: Responses by home language

Figure 12 shows the responses by age. A third of the respondents were in the age group of under 25 years (30%), followed by 25-29 years (27.7%), 30-34 years (13%), 35-39 years (6%), 40-44 years (3.3%) and 45 years and above (1%). However, it was disappointing, but not unexpected that almost 20% of the respondents did not want to answer the age question. The questionnaire erred on the side of ethical courtesy so as to not force any potentially sensitive answers. Nevertheless, the pattern of respondent ages appears reasonable since they were students who are typically in their early twenties.

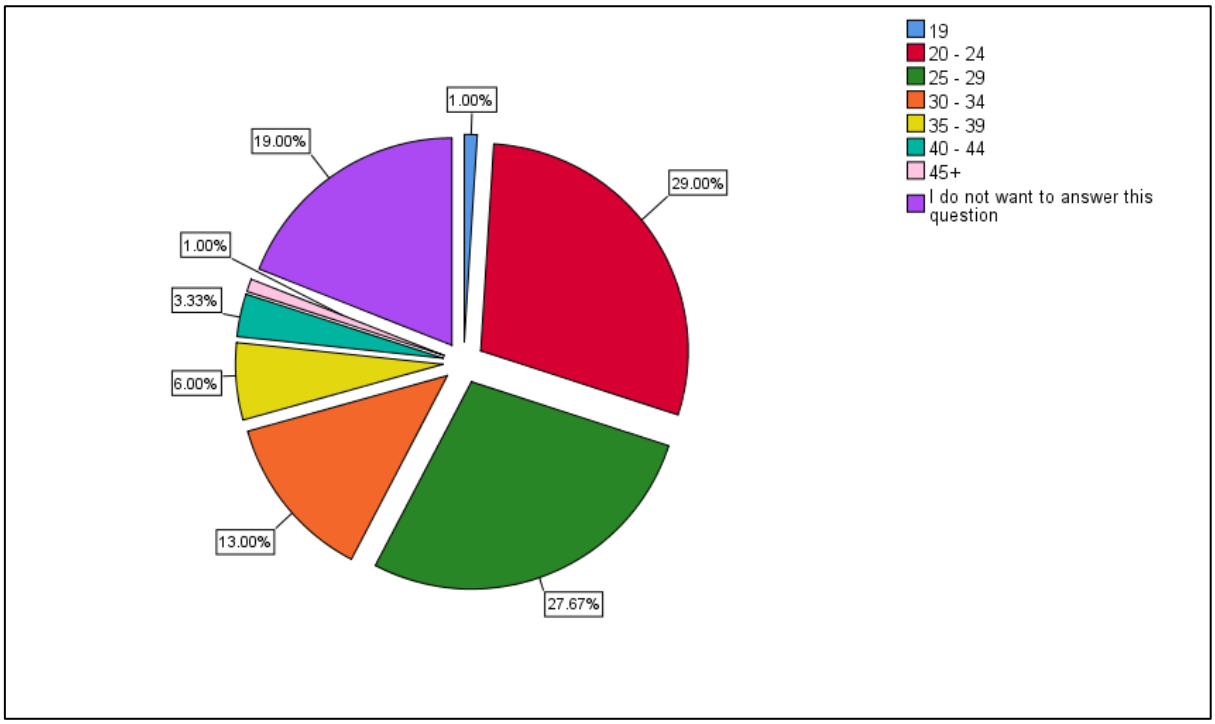

Figure 12: Responses by age

Figure 13 shows the responses by the year level of their subjects/modules/courses. Over half of the respondents were doing their third year subjects/modules/courses, almost a third were doing their second year subjects/modules/courses and rest their first year subjects/modules/courses. So, the majority of the respondents were in their final year and senior students.

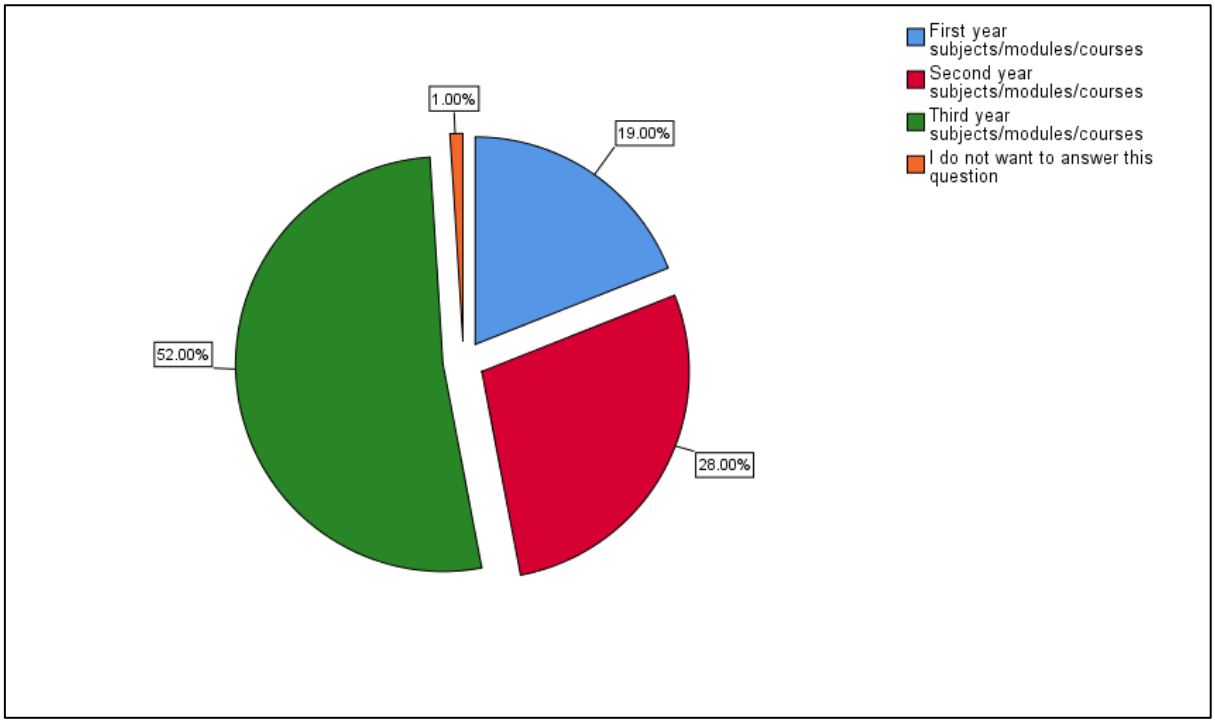

Figure 13: Responses by the year level of the subjects/modules/courses

Figure 14 shows the responses by intended teaching grade range. Just over 60% intend to teach primary school grades and the rest were almost evenly split between early childhood grades and secondary school grades. Nevertheless, all teaching grade ranges were represented.

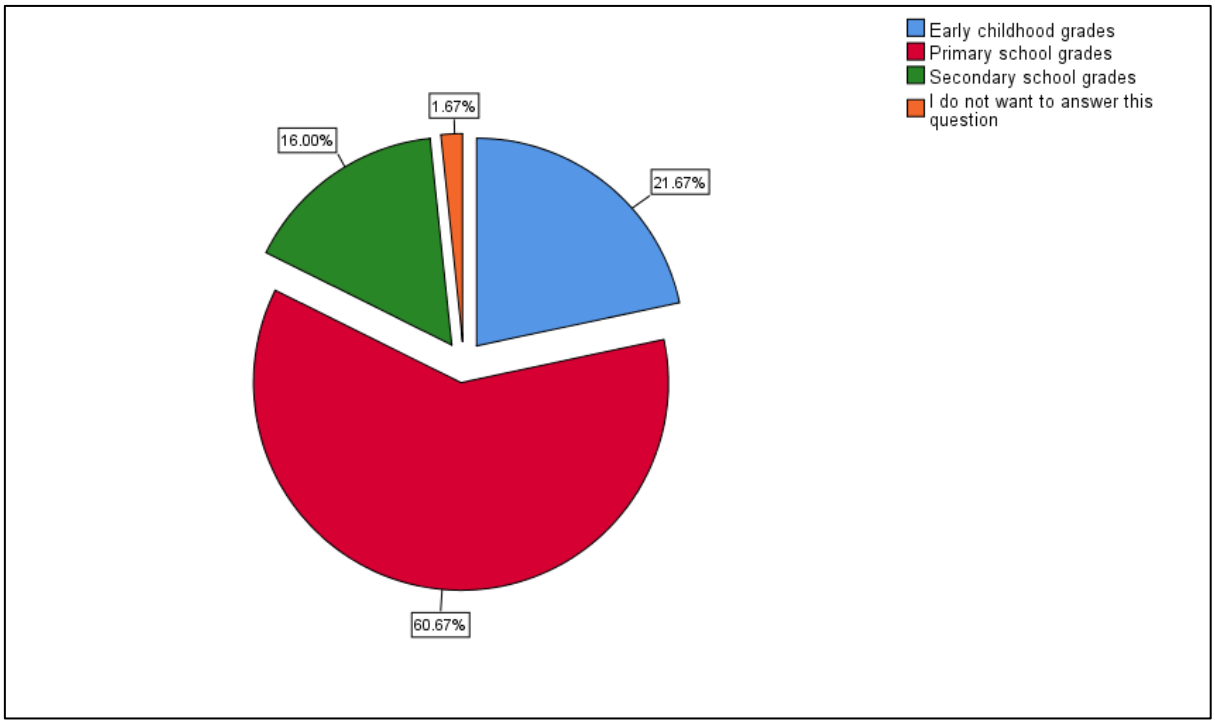

Figure 14: Responses by intended teaching grade range

Figure 15 shows the responses by intended teaching subject category. Three of the subject categories account for almost two thirds of the responses, namely languages with 21.3%, mathematics with 29% and social science with 14%. Computers had 6.7% of the responses, being germane to the study's topic.

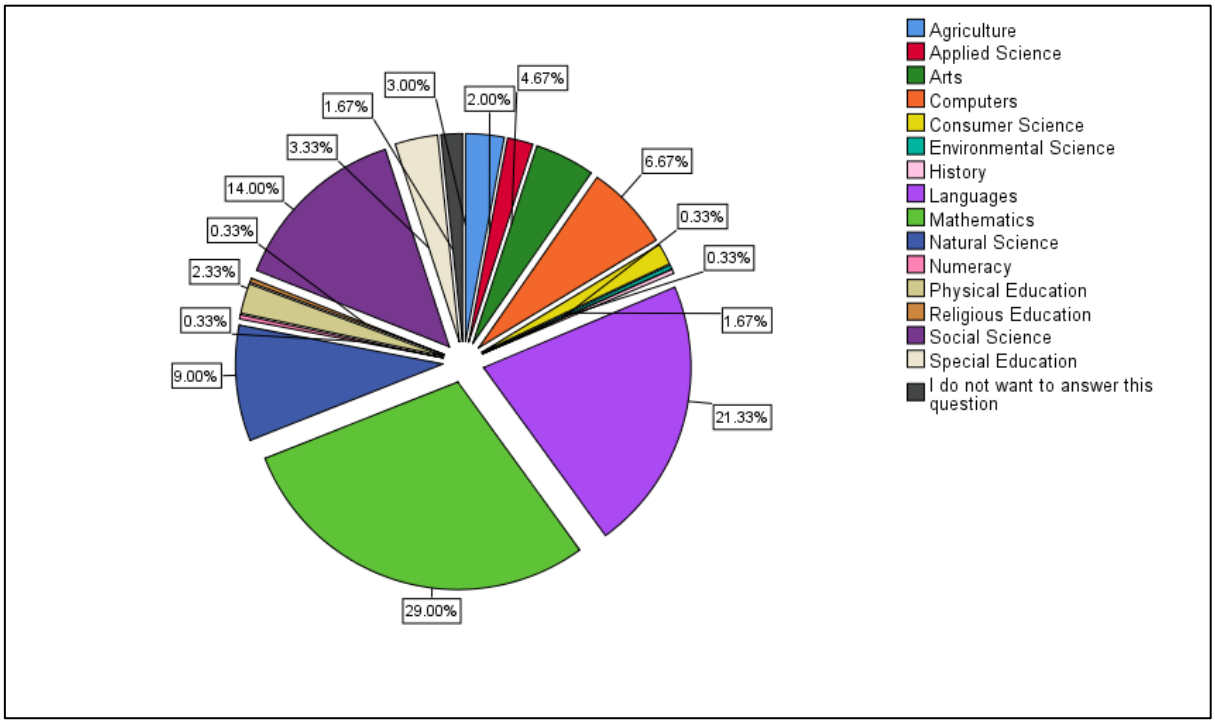

Figure 15: Responses by intended teaching subject category

Figure 16 shows the responses by registered qualification. Almost half of the respondents were registered for a primary teacher's diploma, almost a third for the early childhood education diploma and almost 15% for each of the secondary teacher's diploma and the bachelor of special and inclusive education. There is a resemblance between the responses for the intended teaching grade range and the registered qualifications.

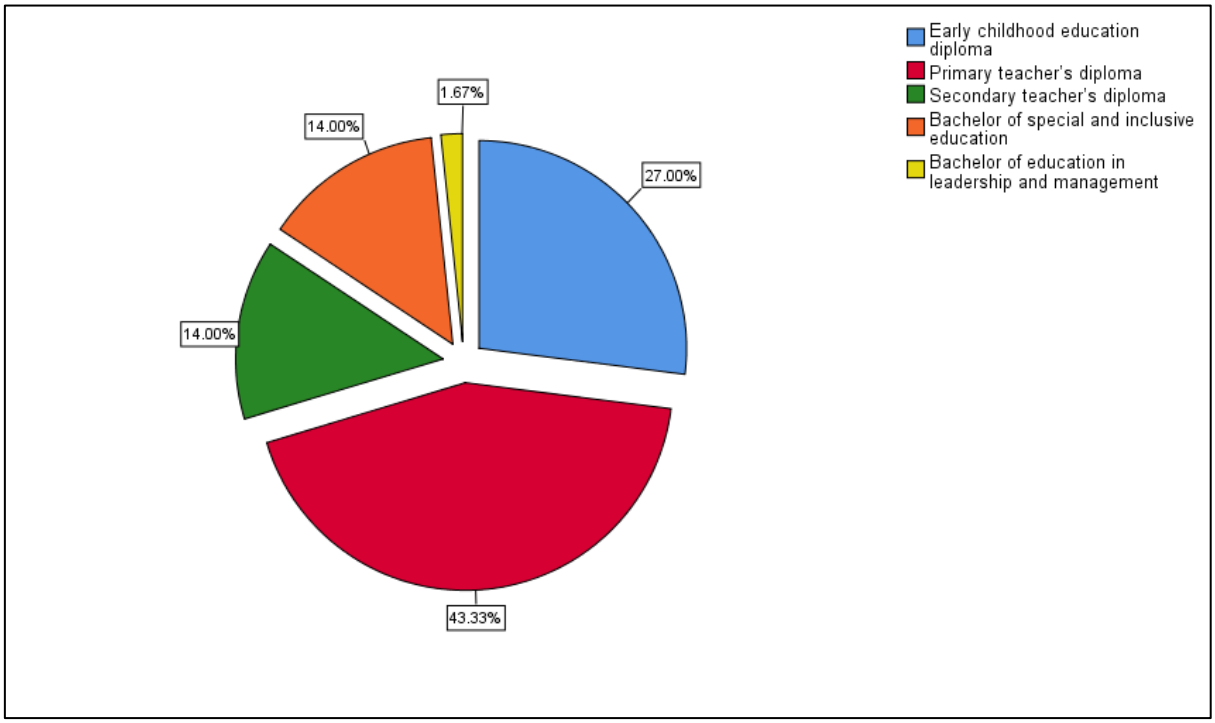

Figure 16: Responses by registered qualification

Figure 17 shows the responses by months of practical teaching experience. A quarter had no practical teaching experience. Just over 40% had less than a year of practical teaching experience. Nine percent had from one year to less than five years of practical teaching experience and 5% had over five years of practical teaching experience. However, and similar to the age question, almost 20% of the respondents did not want to answer the question. Subsequent studies may investigate the reasons for this. Nevertheless, the pattern of responses appears reasonable since they were students who are typically beginning their teaching careers.

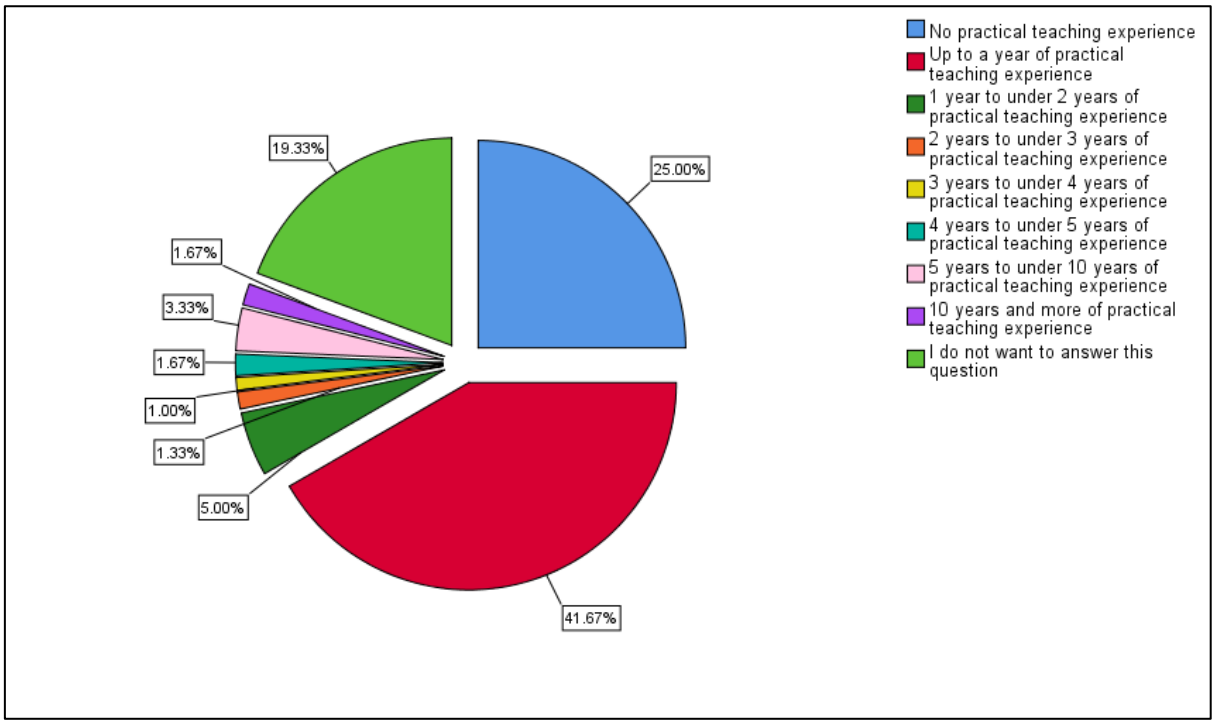

Figure 17: Responses by months of practical teaching experience

4.7 Overall construct levels

The analysis in this section involves the mean summated scores per construct. This is useful for evaluating the overall levels of the responses on each construct. Table 23 presents the overall levels calculated by summing the scores for all the questionnaire items relating to each construct per respondent. Then averaging those summated construct scores across all the respondents. The table is sorted from the highest to the lowest mean values.

Table 23: Overall construct levels

Construct	**Overall construct levels (mean summated score per construct)**
Behavioural Beliefs (BB)	17.47
Attitude Toward Behaviour (ATB)	17.41
Person-related Beliefs (PRB)	17.28
Subjective Norm (SN)	15.76
Level of Awareness (LA)	15.46
Perceived Behavioural Control (PBC)	15.36
Normative Beliefs (NB)	15.12
Behavioural Intention (BI)	15.01
Control Beliefs (CB)	14.19
Behaviour (B)	9.93

The table indicates that behavioural beliefs had the highest mean summated score, which suggests that the students generally believed that teaching Green IT would lead to better environmental outcomes. In contrast, behaviour had the lowest mean summated score, which

is expected, since the respondents were student teachers and not teachers in the field actively teaching learners so their behaviour of teaching Green IT would be limited.

Closely related conceptually to behavioural beliefs is attitude toward behaviour and person-related beliefs. Attitude toward behaviour refers to the extent to which a person has a positive or negative evaluation or appraisal of teaching Green IT and person-related beliefs refers to perceptions about the role of student teachers in advancing the Green IT practices of others. Thus, behavioural beliefs, attitude toward behaviour and person-related beliefs receiving similar values is reasonable.

The remaining constructs had similar mean summated scores, except for control beliefs, which is quite lower. Control beliefs refer to the perceived presence of factors that may facilitate or impede the teaching of Green IT and since student teachers are not in control of the design of the curriculums at the teacher-training colleges, this lower value makes sense.

4.8 One-way analysis of variance (ANOVA)

Relevant literature has noted differences between demographics on certain of the research constructs (Mishra et al., 2014). One-way analysis of variance (ANOVA) is useful to determine if there are any statistically significant differences between the different groups in each demographic for the research model constructs (Mishra et al., 2014). For example, is there a statistically significant difference between males' and females' attitude toward teaching Green IT or is there a statistically significant difference between students younger than twenty-five years and students twenty-five years and older on their intention to teach Green IT? Answers to these types of questions could provide useful insights for the study and for how management should structure any initiatives to improve the teaching of Green IT.

The subsequent analysis in this section examines each demographic separately, but across all 10 of the research model's constructs. Within SPSS, the responses across all items relating to a construct were summed to obtain scores per construct. The resulting scores per construct were used for this analysis. For each demographic an one-way analysis of variance (ANOVA) was performed (Durrheim & Tredoux, 2005). This statistical procedure is appropriate for determining whether there is a systematic variance present in two or more groups on a selected variable. ANOVA does this by comparing the variance within groups to the variance between groups.

An important assumption of ANOVA is homogeneity of variance. For homogeneity of variance, Levene's test of homogeneity of variances was performed. Where the significance (sig.) is greater than or equal to 0.05, the null hypothesis that the variances are equal is not rejected or the homogeneity of variance assumption is not violated. Where the significance

(sig.) is less than 0.05, the null hypothesis is rejected and the assumption violated, in which case the ANOVA results could be misleading and the ANOVA is not interpreted for those constructs.

The ANOVA was processed in SPSS and the ANOVA tables show the sum of squares being the sum of the squared deviations of each item from its mean; degrees of freedom (df) being the number of values in the calculation that are free to vary; mean square being the sum of squares divided by the df; F statistic being the ratio of the mean square between groups and mean square within groups; the significance (sig.) being the p-value or the probability value between zero and one inclusive of obtaining the corresponding estimate when its null hypothesis (no differences between the group means) is true. If the significance (sig.) value is below the specified significance level of 5% or alpha of 0.05 then the probability is very low that the estimate could be observed if the null hypothesis was true, so, the null hypothesis is rejected when the significance (sig.) < 0.05. In contrast, the null hypothesis is not rejected when p >= 0.05. Thus, when the significance (sig.) < 0.05, there is a statistically significant difference between the different groups in that demographic for a research model construct.

However, ANOVA is essentially an omnibus test that uses a single calculation to test all possible comparisons simultaneously and where ANOVA indicates a statistically significant difference, it still does not specify exactly which groups differ. Typically, the post hoc test called Tukey's Honestly Significant Difference (HSD) test is conducted to further examine if there are significant differences between each pair of groups. Notably, even if ANOVA indicates a statistically significant difference, the Tukey's HSD may not since Tukey's HSD controls the Type I error rate and requires a larger difference to declare significance. A type I error occurs when the null hypothesis is rejected but it is actually true.

4.8.1 Gender

Levene's test of homogeneity of variances, Table 24, indicates that ANOVA should proceed for ATB, PBC, BB, CB, BI, LA, PRB (sig. >= 0.05). Table 25 indicates a statistically significant difference on the research model construct ATB (sig. < 0.05). However, Tukey's HSD for gender, Table 26, shows no significant difference for the construct ATB. In conclusion, there are no statistically significant differences between the different gender groups for any of the research model constructs.

Table 24: Levene's test of homogeneity of variances for gender

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
ATB	Based on Mean	.248	2	297	.780

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
SN	Based on Mean	3.130	2	297	.045
PBC	Based on Mean	2.697	2	297	.069
BB	Based on Mean	1.501	2	297	.225
NB	Based on Mean	5.076	2	297	.007
CB	Based on Mean	1.003	2	297	.368
BI	Based on Mean	2.337	2	297	.098
LA	Based on Mean	.336	2	297	.715
PRB	Based on Mean	.013	2	297	.987
B	Based on Mean	3.171	2	297	.043

Table 25: ANOVA for gender

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
ATB	Between Groups	26.187	2	13.094	3.472	.032
	Within Groups	1120.199	297	3.772		
	Total	1146.387	299			
PBC	Between Groups	51.206	2	25.603	2.350	.097
	Within Groups	3235.631	297	10.894		
	Total	3286.837	299			
BB	Between Groups	12.604	2	6.302	1.191	.305
	Within Groups	1572.126	297	5.293		
	Total	1584.730	299			
CB	Between Groups	4.867	2	2.434	.180	.835
	Within Groups	4007.919	297	13.495		
	Total	4012.787	299			
BI	Between Groups	2.208	2	1.104	.093	.911
	Within Groups	3511.779	297	11.824		
	Total	3513.987	299			
LA	Between Groups	15.505	2	7.753	.607	.546
	Within Groups	3795.091	297	12.778		
	Total	3810.597	299			
PRB	Between Groups	26.762	2	13.381	2.162	.117
	Within Groups	1838.155	297	6.189		
	Total	1864.917	299			

Table 26: Tukey's HSD for gender

Multiple Comparisons							
Tukey HSD							
Dependent Variable	(I) 1. I am:	(J) 1. I am:	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
ATB	Male	Female	-.44791	.22824	.123	-.9855	.0897
		I do not want to answer this question	2.16129	1.38430	.264	-1.0995	5.4220
	Female	Male	.44791	.22824	.123	-.0897	.9855
		I do not want to answer this question	2.60920	1.38114	.144	-.6441	5.8625
	I do not want to answer this question	Male	-2.16129	1.38430	.264	-5.4220	1.0995
		Female	-2.60920	1.38114	.144	-5.8625	.6441

4.8.2 Home language

Levene's test of homogeneity of variances, Table 27, indicates that ANOVA should proceed for all except PRB (sig. < 0.05). Table 28 indicates a statistically significant difference on the research model construct BB (sig. < 0.05). However, Tukey's HSD, Table 29, was not performed for BB because at least one group has fewer than two cases. There were 293 Swazi, 1 Zulu and 6 English home language responses, which makes it difficult to compare these groups since they are very uneven. As such, the study proceeds with no statistically significant differences between the different home language groups for any of the research model constructs.

Table 27: Levene's test of homogeneity of variances for home language

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
ATB	Based on Mean	.077	1	297	.782
SN	Based on Mean	.258	1	297	.612
PBC	Based on Mean	.241	1	297	.624
BB	Based on Mean	1.644	1	297	.201
NB	Based on Mean	.001	1	297	.976
CB	Based on Mean	.989	1	297	.321
BI	Based on Mean	1.616	1	297	.205
LA	Based on Mean	.050	1	297	.823
PRB	Based on Mean	8.716	1	297	.003
B	Based on Mean	.448	1	297	.504

Table 28: ANOVA for home language

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
ATB	Between Groups	9.938	2	4.969	1.299	.274
	Within Groups	1136.449	297	3.826		
	Total	1146.387	299			
SN	Between Groups	1.926	2	.963	.132	.876
	Within Groups	2159.311	297	7.270		
	Total	2161.237	299			
PBC	Between Groups	13.305	2	6.653	.604	.548
	Within Groups	3273.531	297	11.022		
	Total	3286.837	299			
BB	Between Groups	72.654	2	36.327	7.135	.001
	Within Groups	1512.076	297	5.091		
	Total	1584.730	299			
NB	Between Groups	8.307	2	4.153	.469	.626
	Within Groups	2630.130	297	8.856		
	Total	2638.437	299			
CB	Between Groups	27.073	2	13.536	1.009	.366
	Within Groups	3985.714	297	13.420		
	Total	4012.787	299			
BI	Between Groups	24.430	2	12.215	1.040	.355
	Within Groups	3489.557	297	11.749		
	Total	3513.987	299			
LA	Between Groups	15.681	2	7.841	.614	.542
	Within Groups	3794.915	297	12.777		
	Total	3810.597	299			
B	Between Groups	29.738	2	14.869	.876	.417
	Within Groups	5038.928	297	16.966		
	Total	5068.667	299			

Table 29: Tukey's HSD for home language

Post hoc tests are not performed for BB because at least one group has fewer than two cases.

4.8.3 Age

Levene's test of homogeneity of variances, Table 30, indicates that ANOVA should proceed for all constructs (sig. >= 0.05). Table 31 indicates a statistically significant difference on the research model construct LA (sig. < 0.05). However, Tukey's HSD, Table 32, shows significant differences between the "I do not want to answer this question" and "20 – 24" pair and the "I do not want to answer this question" and "25 – 29" pair only for the construct LA. In conclusion, the "I do not want to answer this question" group offers little information and

insight for the purposes of this analysis, so, the study proceeds with no statistically significant differences between the different age groups for any of the research model constructs.

Table 30: Levene's test of homogeneity of variances for age

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
ATB	Based on Mean	1.973	7	292	.059
SN	Based on Mean	.531	7	292	.811
PBC	Based on Mean	1.348	7	292	.227
BB	Based on Mean	1.178	7	292	.315
NB	Based on Mean	1.104	7	292	.361
CB	Based on Mean	.984	7	292	.443
BI	Based on Mean	1.346	7	292	.228
LA	Based on Mean	1.946	7	292	.062
PRB	Based on Mean	1.206	7	292	.299
B	Based on Mean	.177	7	292	.990

Table 31: ANOVA for age

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
ATB	Between Groups	26.331	7	3.762	.981	.445
	Within Groups	1120.056	292	3.836		
	Total	1146.387	299			
SN	Between Groups	50.092	7	7.156	.990	.439
	Within Groups	2111.145	292	7.230		
	Total	2161.237	299			
PBC	Between Groups	130.489	7	18.641	1.725	.103
	Within Groups	3156.347	292	10.809		
	Total	3286.837	299			
BB	Between Groups	16.748	7	2.393	.446	.873
	Within Groups	1567.982	292	5.370		
	Total	1584.730	299			
NB	Between Groups	35.856	7	5.122	.575	.776
	Within Groups	2602.581	292	8.913		
	Total	2638.437	299			
CB	Between Groups	64.119	7	9.160	.677	.691
	Within Groups	3948.668	292	13.523		
	Total	4012.787	299			
BI	Between Groups	140.776	7	20.111	1.741	.099
	Within Groups	3373.211	292	11.552		
	Total	3513.987	299			
LA	Between Groups	231.373	7	33.053	2.697	.010
	Within Groups	3579.223	292	12.258		
	Total	3810.597	299			
PRB	Between Groups	32.117	7	4.588	.731	.646
	Within Groups	1832.800	292	6.277		
	Total	1864.917	299			
B	Between Groups	102.708	7	14.673	.863	.536
	Within Groups	4965.958	292	17.007		
	Total	5068.667	299			

Table 32: Tukey's HSD for age

Multiple Comparisons							
Tukey HSD							
Dependent Variable	(I) 3. I am ____ years old. (leave blank if you do not want to answer this question) (Binned)	(J) 3. I am ____ years old. (leave blank if you do not want to answer this question) (Binned)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LA	19	20 - 24	-1.63218	2.05591	.993	-7.9090	4.6446
		25 - 29	-1.44177	2.05756	.997	-7.7236	4.8401
		30 - 34	-.20513	2.09766	1.000	-6.6094	6.1991
		35 - 39	.00000	2.18331	1.000	-6.6658	6.6658
		40 - 44	.06667	2.30470	1.000	-6.9697	7.1030
		45+	.00000	2.85863	1.000	-8.7275	8.7275
		I do not want to answer this question	.52632	2.07387	1.000	-5.8053	6.8579
	20 - 24	19	1.63218	2.05591	.993	-4.6446	7.9090
		25 - 29	.19042	.53719	1.000	-1.4497	1.8305
		30 - 34	1.42706	.67468	.408	-.6328	3.4869
		35 - 39	1.63218	.90657	.620	-1.1356	4.4000
		40 - 44	1.69885	1.16904	.831	-1.8703	5.2680
		45+	1.63218	2.05591	.993	-4.6446	7.9090
		I do not want to answer this question	2.15850*	.59661	.008	.3370	3.9800
	25 - 29	19	1.44177	2.05756	.997	-4.8401	7.7236
		20 - 24	-.19042	.53719	1.000	-1.8305	1.4497
		30 - 34	1.23664	.67969	.607	-.8385	3.3118
		35 - 39	1.44177	.91031	.760	-1.3375	4.2210
		40 - 44	1.50843	1.17194	.903	-2.0696	5.0864
		45+	1.44177	2.05756	.997	-4.8401	7.7236
		I do not want to answer this question	1.96808*	.60227	.026	.1293	3.8068
	30 - 34	19	.20513	2.09766	1.000	-6.1991	6.6094
		20 - 24	-1.42706	.67468	.408	-3.4869	.6328
		25 - 29	-1.23664	.67969	.607	-3.3118	.8385
		35 - 39	.20513	.99764	1.000	-2.8407	3.2510
		40 - 44	.27179	1.24099	1.000	-3.5170	4.0606
		45+	.20513	2.09766	1.000	-6.1991	6.6094
		I do not want to answer this question	.73144	.72756	.973	-1.4898	2.9527
	35 - 39	19	.00000	2.18331	1.000	-6.6658	6.6658
		20 - 24	-1.63218	.90657	.620	-4.4000	1.1356
		25 - 29	-1.44177	.91031	.760	-4.2210	1.3375

Multiple Comparisons							
Tukey HSD							
		30 - 34	-.20513	.99764	1.000	-3.2510	2.8407
		40 - 44	.06667	1.38085	1.000	-4.1491	4.2825
		45+	.00000	2.18331	1.000	-6.6658	6.6658
		I do not want to answer this question	.52632	.94659	.999	-2.3637	3.4163
	40 - 44	19	-.06667	2.30470	1.000	-7.1030	6.9697
		20 - 24	-1.69885	1.16904	.831	-5.2680	1.8703
		25 - 29	-1.50843	1.17194	.903	-5.0864	2.0696
		30 - 34	-.27179	1.24099	1.000	-4.0606	3.5170
		35 - 39	-.06667	1.38085	1.000	-4.2825	4.1491
		45+	-.06667	2.30470	1.000	-7.1030	6.9697
		I do not want to answer this question	.45965	1.20034	1.000	-3.2050	4.1243
	45+	19	.00000	2.85863	1.000	-8.7275	8.7275
		20 - 24	-1.63218	2.05591	.993	-7.9090	4.6446
		25 - 29	-1.44177	2.05756	.997	-7.7236	4.8401
		30 - 34	-.20513	2.09766	1.000	-6.6094	6.1991
		35 - 39	.00000	2.18331	1.000	-6.6658	6.6658
		40 - 44	.06667	2.30470	1.000	-6.9697	7.1030
		I do not want to answer this question	.52632	2.07387	1.000	-5.8053	6.8579
	I do not want to answer this question	19	-.52632	2.07387	1.000	-6.8579	5.8053
		20 - 24	-2.15850*	.59661	.008	-3.9800	-.3370
		25 - 29	-1.96808*	.60227	.026	-3.8068	-.1293
		30 - 34	-.73144	.72756	.973	-2.9527	1.4898
		35 - 39	-.52632	.94659	.999	-3.4163	2.3637
		40 - 44	-.45965	1.20034	1.000	-4.1243	3.2050
		45+	-.52632	2.07387	1.000	-6.8579	5.8053

4.8.4 Year level of subjects/modules/courses

Levene's test of homogeneity of variances, Table 33, indicates that ANOVA should proceed for all except LA and B (sig.< 0.05). Table 34 indicates no statistically significant differences on any of the research model constructs (sig. < 0.05). In conclusion, there are no statistically significant differences between the different subjects/modules/courses groups for any of the research model constructs.

Table 33: Levene's test of homogeneity of variances for year level of subjects/modules/courses

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
ATB	Based on Mean	1.388	3	296	.247
SN	Based on Mean	.517	3	296	.671
PBC	Based on Mean	1.946	3	296	.122
BB	Based on Mean	1.362	3	296	.255
NB	Based on Mean	.112	3	296	.953
CB	Based on Mean	.871	3	296	.456
BI	Based on Mean	.151	3	296	.929
LA	Based on Mean	14.295	3	296	.000
PRB	Based on Mean	1.134	3	296	.335
B	Based on Mean	5.071	3	296	.002

Table 34: ANOVA for year level of subjects/modules/courses

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
ATB	Between Groups	8.442	3	2.814	.732	.534
	Within Groups	1137.945	296	3.844		
	Total	1146.387	299			
SN	Between Groups	9.547	3	3.182	.438	.726
	Within Groups	2151.689	296	7.269		
	Total	2161.237	299			
PBC	Between Groups	51.628	3	17.209	1.575	.196
	Within Groups	3235.209	296	10.930		
	Total	3286.837	299			
BB	Between Groups	23.272	3	7.757	1.471	.223
	Within Groups	1561.458	296	5.275		
	Total	1584.730	299			
NB	Between Groups	3.350	3	1.117	.125	.945
	Within Groups	2635.087	296	8.902		
	Total	2638.437	299			
CB	Between Groups	60.970	3	20.323	1.522	.209
	Within Groups	3951.816	296	13.351		
	Total	4012.787	299			
BI	Between Groups	8.554	3	2.851	.241	.868
	Within Groups	3505.433	296	11.843		
	Total	3513.987	299			
PRB	Between Groups	17.460	3	5.820	.932	.425
	Within Groups	1847.457	296	6.241		
	Total	1864.917	299			

4.8.5 Teaching grade range

Levene's test of homogeneity of variances, Table 35, indicates that ANOVA should proceed for all except NB, LA and B (sig. < 0.05). Table 36 indicates a statistically significant difference on the research model construct BI (sig. < 0.05). Tukey's HSD, Table 37, shows a significant difference between the groups "early childhood grades" and "primary school grades" for the construct BI. In conclusion, there is a statistically significant difference between the groups "early childhood grades" and "primary school grades" for the research model construct BI. Thus, respondents intending to teach early childhood grades differ significantly from those respondents intending to teach primary school grades in their behavioural intention to teach Green IT. The respondents intending to teach early childhood grades had a lower mean of 14.138 while respondents intending to teach primary school grades had a mean of 15.560. The means are significantly different and additional attention via Green IT initiatives could potentially benefit student teachers intending to teach early childhood grades to help them improve their Green IT teaching.

Table 35: Levene's test of homogeneity of variances for teaching grade range

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
ATB	Based on Mean	1.506	3	296	.213
SN	Based on Mean	1.911	3	296	.128
PBC	Based on Mean	.660	3	296	.577
BB	Based on Mean	1.122	3	296	.341
NB	Based on Mean	3.904	3	296	.009
CB	Based on Mean	.892	3	296	.445
BI	Based on Mean	1.076	3	296	.360
LA	Based on Mean	3.449	3	296	.017
PRB	Based on Mean	1.576	3	296	.195
B	Based on Mean	6.915	3	296	.000

Table 36: ANOVA for teaching grade range

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
ATB	Between Groups	12.781	3	4.260	1.112	.344
	Within Groups	1133.606	296	3.830		
	Total	1146.387	299			
SN	Between Groups	42.217	3	14.072	1.966	.119
	Within Groups	2119.020	296	7.159		
	Total	2161.237	299			
PBC	Between Groups	71.916	3	23.972	2.207	.087
	Within Groups	3214.920	296	10.861		
	Total	3286.837	299			
BB	Between Groups	12.587	3	4.196	.790	.500
	Within Groups	1572.143	296	5.311		
	Total	1584.730	299			
CB	Between Groups	20.228	3	6.743	.500	.683
	Within Groups	3992.558	296	13.488		
	Total	4012.787	299			
BI	Between Groups	149.481	3	49.827	4.384	.005
	Within Groups	3364.506	296	11.367		
	Total	3513.987	299			
PRB	Between Groups	22.794	3	7.598	1.221	.302
	Within Groups	1842.122	296	6.223		
	Total	1864.917	299			

Table 37: Tukey's HSD for teaching grade range

Multiple Comparisons							
Tukey HSD							
Dependent Variable	(I) 5. When I start teaching, I want to teach the following teaching grade range:	(J) 5. When I start teaching, I want to teach the following teaching grade range:	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
BI	Early childhood grades	Primary school grades	-1.42198*	.48716	.020	-2.6806	-.1633
		Secondary school grades	-.15321	.64162	.995	-1.8109	1.5045
		I do not want to answer this question	1.13846	1.56467	.886	-2.9041	5.1811
	Primary school grades	Early childhood grades	1.42198*	.48716	.020	.1633	2.6806
		Secondary school grades	1.26877	.54704	.096	-.1446	2.6822
		I do not want to answer this question	2.56044	1.52832	.339	-1.3883	6.5091
	Secondary school grades	Early childhood grades	.15321	.64162	.995	-1.5045	1.8109
		Primary school grades	-1.26877	.54704	.096	-2.6822	.1446
		I do not want to answer this question	1.29167	1.58434	.847	-2.8018	5.3851
	I do not want to answer this question	Early childhood grades	-1.13846	1.56467	.886	-5.1811	2.9041
		Primary school grades	-2.56044	1.52832	.339	-6.5091	1.3883
		Secondary school grades	-1.29167	1.58434	.847	-5.3851	2.8018

4.8.6 Subject category

Levene's test of homogeneity of variances, Table 38, indicates that ANOVA should proceed for all constructs except SN, NB, LA (sig. < 0.05). Table 39 indicates a statistically significant difference on the research model construct PRB (sig. < 0.05). However, Tukey's HSD, Table 40, was not performed for PRB because at least one group has fewer than two cases. There are 16 groups with wide response variation, which makes it difficult to compare these groups since they are very uneven. As such, the study proceeds with no statistically significant differences between the different subject category groups for any of the research model constructs.

Table 38: Levene's test of homogeneity of variances for subject category

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
ATB	Based on Mean	1.639	11	284	.088
SN	Based on Mean	2.058	11	284	.023
PBC	Based on Mean	1.146	11	284	.325
BB	Based on Mean	1.420	11	284	.163
NB	Based on Mean	2.773	11	284	.002
CB	Based on Mean	1.558	11	284	.111
BI	Based on Mean	.401	11	284	.955
LA	Based on Mean	2.048	11	284	.024
PRB	Based on Mean	.966	11	284	.478
B	Based on Mean	1.182	11	284	.299

Table 39: ANOVA for subject category

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
ATB	Between Groups	56.814	15	3.788	.987	.469
	Within Groups	1089.573	284	3.837		
	Total	1146.387	299			
PBC	Between Groups	237.108	15	15.807	1.472	.115
	Within Groups	3049.728	284	10.738		
	Total	3286.837	299			
BB	Between Groups	60.747	15	4.050	.755	.727
	Within Groups	1523.983	284	5.366		
	Total	1584.730	299			
CB	Between Groups	234.609	15	15.641	1.176	.290
	Within Groups	3778.177	284	13.303		
	Total	4012.787	299			
BI	Between Groups	198.725	15	13.248	1.135	.324
	Within Groups	3315.262	284	11.673		
	Total	3513.987	299			
PRB	Between Groups	199.630	15	13.309	2.270	.005
	Within Groups	1665.287	284	5.864		
	Total	1864.917	299			
B	Between Groups	214.566	15	14.304	.837	.636
	Within Groups	4854.101	284	17.092		
	Total	5068.667	299			

Table 40: Tukey's HSD for subject category

Post hoc tests are not performed for PRB because at least one group has fewer than two cases.

4.8.7 Qualification registered

Levene's test of homogeneity of variances, Table 41, indicates that ANOVA should proceed for all constructs except PBC, BB, NB, LA and B (sig. < 0.05). Table 42 indicates a statistically significant difference on the research model construct BI (sig. < 0.05). Similar to teaching grade range, Tukey's HSD, Table 43, shows a significant difference between the groups "early childhood education diploma" and "primary teacher's diploma" for the construct BI. In addition, Tukey's HSD, Table 43, shows a significant difference between the groups "bachelor of special and inclusive education" and "primary teacher's diploma" for the construct BI. In conclusion, there is a statistically significant difference between these two pairs of groups for the research model construct BI. Thus, respondents registered for these qualifications differ significantly in their behavioural intention to teach Green IT. The respondents registered for the primary teacher's diploma had a mean of 15.9077, respondents registered for the early childhood education diploma had a lower mean of 14.5309 and respondents registered for the bachelor of special and inclusive education had the lowest mean of 13.7857. The means are significantly different on the aforementioned pairs and additional attention via Green IT initiatives could potentially benefit student teachers registered for the early childhood education diploma and the bachelor of special and inclusive education to help them improve their Green IT teaching.

Table 41: Levene's test of homogeneity of variances for qualification registered

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
ATB	Based on Mean	1.192	4	295	.314
SN	Based on Mean	1.941	4	295	.104
PBC	Based on Mean	4.984	4	295	.001
BB	Based on Mean	2.442	4	295	.047
NB	Based on Mean	4.161	4	295	.003
CB	Based on Mean	1.797	4	295	.129
BI	Based on Mean	1.982	4	295	.097
LA	Based on Mean	7.812	4	295	.000
PRB	Based on Mean	2.033	4	295	.090
B	Based on Mean	6.833	4	295	.000

Table 42: ANOVA for qualification registered

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
ATB	Between Groups	17.870	4	4.468	1.168	.325
	Within Groups	1128.517	295	3.825		
	Total	1146.387	299			
SN	Between Groups	35.397	4	8.849	1.228	.299
	Within Groups	2125.840	295	7.206		
	Total	2161.237	299			
CB	Between Groups	63.327	4	15.832	1.183	.319
	Within Groups	3949.460	295	13.388		
	Total	4012.787	299			
BI	Between Groups	203.374	4	50.843	4.531	.001
	Within Groups	3310.613	295	11.222		
	Total	3513.987	299			
PRB	Between Groups	49.112	4	12.278	1.995	.095
	Within Groups	1815.805	295	6.155		
	Total	1864.917	299			

Table 43: Tukey's HSD for qualification registered

Multiple Comparisons							
Tukey HSD							
Dependent Variable	(I) 7. This year, I am registered for the following qualification:	(J) 7. This year, I am registered for the following qualification:	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
BI	Early childhood education diploma	Primary teacher's diploma	-1.37683*	.47421	.032	-2.6784	-.0753
		Secondary teacher's diploma	.05467	.63698	1.000	-1.6937	1.8030
		Bachelor of special and inclusive education	.74515	.63698	.769	-1.0032	2.4935
		Bachelor of education in leadership and management	.53086	1.54371	.997	-3.7062	4.7679
	Primary teacher's diploma	Early childhood education diploma	1.37683*	.47421	.032	.0753	2.6784
		Secondary teacher's diploma	1.43150	.59458	.116	-.2005	3.0635
		Bachelor of special and inclusive education	2.12198*	.59458	.004	.4900	3.7539
		Bachelor of education in leadership and management	1.90769	1.52670	.722	-2.2827	6.0981
	Secondary teacher's diploma	Early childhood education diploma	-.05467	.63698	1.000	-1.8030	1.6937
		Primary teacher's diploma	-1.43150	.59458	.116	-3.0635	.2005
		Bachelor of special and inclusive education	.69048	.73103	.879	-1.3160	2.6969
		Bachelor of education in leadership and management	.47619	1.58483	.998	-3.8737	4.8261
	Bachelor of special and inclusive education	Early childhood education diploma	-.74515	.63698	.769	-2.4935	1.0032
		Primary teacher's diploma	-2.12198*	.59458	.004	-3.7539	-.4900
		Secondary teacher's diploma	-.69048	.73103	.879	-2.6969	1.3160

Multiple Comparisons							
Tukey HSD							
Dependent Variable	(I) 7. This year, I am registered for the following qualification:	(J) 7. This year, I am registered for the following qualification:	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
		Bachelor of education in leadership and management	-.21429	1.58483	1.000	-4.5642	4.1356
	Bachelor of education in leadership and management	Early childhood education diploma	-.53086	1.54371	.997	-4.7679	3.7062
		Primary teacher's diploma	-1.90769	1.52670	.722	-6.0981	2.2827
		Secondary teacher's diploma	-.47619	1.58483	.998	-4.8261	3.8737
		Bachelor of special and inclusive education	.21429	1.58483	1.000	-4.1356	4.5642

4.8.8 Practical teaching experience

Levene's test of homogeneity of variances, Table 44, indicates that ANOVA should proceed for all constructs except LA and B (sig. < 0.05). Table 45 indicates no statistically significant differences on any of the research model constructs (sig. < 0.05). In conclusion, there are no statistically significant differences between the different practical teaching experience groups for any of the research model constructs.

Table 44: Levene's test of homogeneity of variances for practical teaching experience

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
ATB	Based on Mean	1.231	8	291	.280
SN	Based on Mean	.658	8	291	.728
PBC	Based on Mean	1.334	8	291	.226
BB	Based on Mean	1.836	8	291	.070
NB	Based on Mean	1.323	8	291	.231
CB	Based on Mean	.807	8	291	.597
BI	Based on Mean	.791	8	291	.611
LA	Based on Mean	5.734	8	291	.000
PRB	Based on Mean	.896	8	291	.520
B	Based on Mean	2.643	8	291	.008

Table 45: ANOVA for practical teaching experience

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
ATB	Between Groups	47.153	8	5.894	1.560	.136
	Within Groups	1099.233	291	3.777		
	Total	1146.387	299			
SN	Between Groups	58.052	8	7.257	1.004	.433
	Within Groups	2103.185	291	7.227		
	Total	2161.237	299			
PBC	Between Groups	114.178	8	14.272	1.309	.238
	Within Groups	3172.659	291	10.903		
	Total	3286.837	299			
BB	Between Groups	68.126	8	8.516	1.634	.115
	Within Groups	1516.604	291	5.212		
	Total	1584.730	299			
NB	Between Groups	94.319	8	11.790	1.349	.219
	Within Groups	2544.117	291	8.743		
	Total	2638.437	299			
CB	Between Groups	77.704	8	9.713	.718	.675
	Within Groups	3935.082	291	13.523		
	Total	4012.787	299			
BI	Between Groups	144.637	8	18.080	1.561	.136
	Within Groups	3369.350	291	11.579		
	Total	3513.987	299			
PRB	Between Groups	61.489	8	7.686	1.240	.275
	Within Groups	1803.428	291	6.197		
	Total	1864.917	299			

4.9 Structural equation modeling (SEM)

4.9.1 SEM software and version used to fit the model

Structural equation modeling (SEM) is used to test the study's hypotheses, establish associations between the constructs, evaluate the research model and answer research question two. While SPSS was used for all the preceding statistical analyses, it was not used for the SEM analysis because the researcher did not have access to AMOS statistical software, which is an added SPSS module that has SEM processing features. AMOS is an acronym for analysis of moment structures.

The SEM analysis was run on the lavaan version 0.6-1 software package (Rosseel, 2012), which is free, well-tested and commercial-quality software for latent variable modelling. lavaan is an acronym for latent variable analysis. lavaan is implemented as an R package and R is a well-established language and environment for statistical computing and graphics.

4.9.2 SEM model fit measures and criteria

The covariance matrix for the study's dataset is provided in Appendix F so that the reader can replicate the SEM processing and output for this study if required. Model fit addresses how well the SEM model fits the sampled data to ensure that there is not a large discrepancy between the observed and theoretical relations (Boomsma, 2000). lavaan, using the Maximum Likelihood (ML) method, provided a number of model fit indices that point to an acceptable fit when considered together with the study's extensive theoretical evidence from the literature that supports the research model. Nevertheless, there are a few indices that indicate that there may be other models, statistically, that could provide better fits. This provides opportunities for future research, but would still require ample complementary theoretical justification to support any alternative model.

The first model fit index is the chi-square test statistic, which is an absolute or predictive fit index. The chi-square test values were $\chi^2(716) = 1382.615$, $p < 0.001$. Subsequently, the ratio of the chi-square test statistic divided by the degrees of freedom (CMIN/df) = 1382.615 / 716 = 1.931 is below the maximum recommended value of 3 and, therefore, suggests a good fit (Scheiber, Nora, Stage, Barlow, & King, 2006). Another index is the root mean squared error of approximation (RMSEA) = 0.056 (90% confidence interval = 0.051-0.060), which is below the maximum recommended value of 0.06 (Hu & Bentler, 1999; Scheiber et al., 2006) and, therefore, suggests an acceptable fit. Thus, these two indices suggest an acceptable fit. In addition, the comparative fit index (CFI) = 0.907, which is just above the minimum recommended value of 0.90 and approaching the cut-off value of 0.95 (Hu & Bentler, 1999) also suggests an acceptable fit.

However, the Tucker-Lewis index (TLI) or non-normed fit index (NNFI) = 0.899 is just below the minimum recommended value of 0.90 required for an acceptable fit and away from the cut-off value of 0.95 (Hu & Bentler, 1999), and the standardised root mean squared residual (SRMR) = 0.110 is above the maximum recommended value of 0.08 required for an acceptable fit and above the cut-off value of 0.09 (Hu & Bentler, 1999). These indices indicate that there may be other models, statistically, that could provide better fits.

Nevertheless, since the ratio CMIN/df, RMSEA and CFI suggest an acceptable fit and the study has provided extensive theoretical evidence from the literature to support the research model, investigating alternative models with optimal index values is left for future research and would still require ample complementary theoretical justification to support any alternative model. Importantly, there is enough statistical support to proceed with the SEM model for the purposes of the study.

4.9.3 SEM model parameter estimates

Figure 18 depicts the research model following the SEM processing, comprising the model's latent variables or constructs represented by circles, and solid and dashed lines with arrows that represent the hypothesized relationships among the latent variables. A solid line indicates that there is a statistically significant influence where $p < 0.05$ and a dashed line indicates the influence is not statistically significant where $p >= 0.05$. The direction of an influence of one latent variable on another is represented by the direction of the corresponding single-headed arrow.

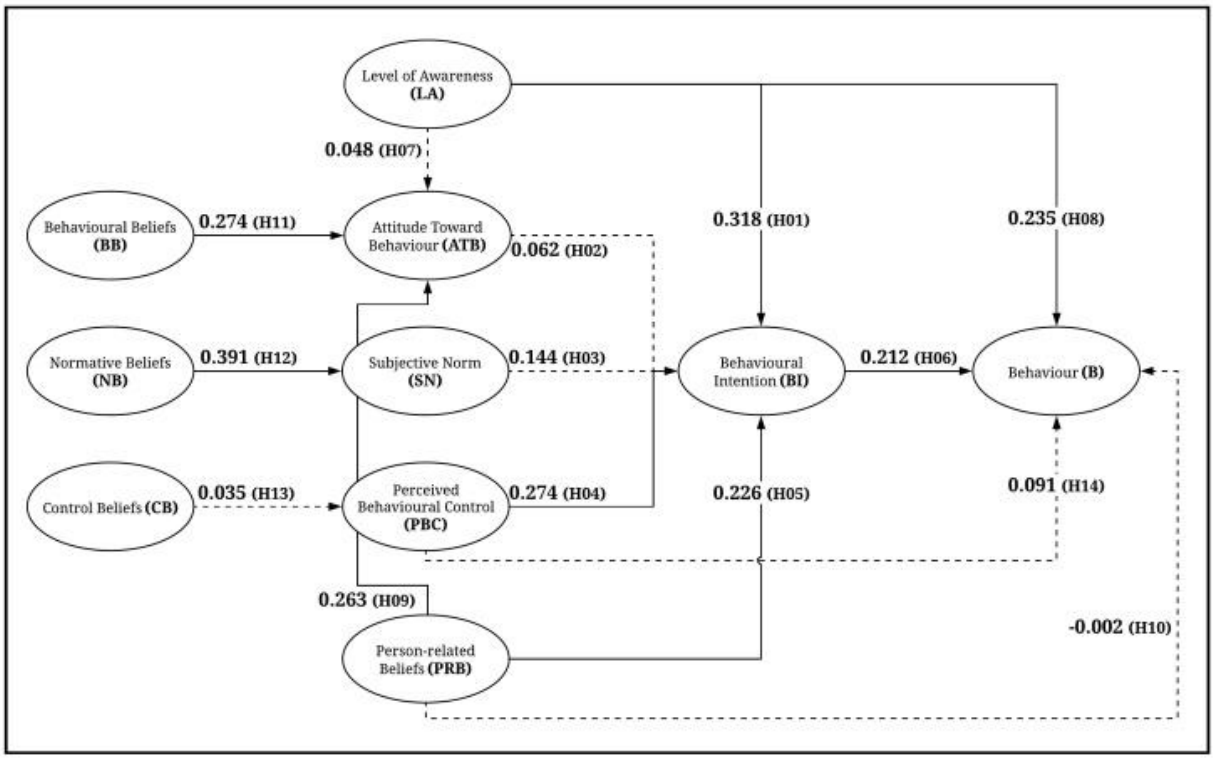

Figure 18: SEM results for the study's research model

Table 46 is the lavaan output showing the parameter estimates of the SEM model. The column labelled "Estimate" contains the unstandardized linear regression coefficients for each set of independent and dependent variables. The column labelled "Std.Err" contains the standard error values of the estimates and is a measure of the accuracy of the estimates where lower values indicate better accuracy. The column labelled "z-value" contains values equal to the "Estimate" values divided by the "Std.Err" values. In lavaan, the "z-values" are based on the Wald test and provide a measure of how many standard deviations away, negative or positive, from the mean of zero an estimate is.

The column labelled "P(>|z|)" contains the probability value, between zero and one inclusive, of obtaining the corresponding estimate when its null hypothesis is true or when there is no relationship between that independent and dependent variable. This is also known as the p-

value and if it is below the specified significance level of 5% or alpha of 0.05, then the probability is very low that the estimate could be observed if the null hypothesis is true, so, the null hypothesis is rejected when p < 0.05. Similarly, the null hypothesis is not rejected when p >= 0.05. Therefore, in Figure 18, where a p-value >= 0.05 for a relationship between two constructs as hypothesized by the research model, then the relationship is not statistically significant and represented by a dashed line. Where the p-value < 0.05 for a relationship, then the relationship is statistically significant and represented by a solid line. Only statistically significant relationships are regarded as having an influence in the model.

The column labelled "Std.lv" contains the standardised estimate values with a mean of zero and a standard deviation of one. These standardised estimate values are shown in Figure 18 for each relationship between two constructs as hypothesized by the research model. The applicable hypothesis number is also shown in brackets next to each standardised estimate value in Figure 18.

Table 46: lavaan output showing the parameter estimates of the SEM model

Dependent Variable	Independent Variable	Estimate	Std.Err	z-value	P(>|z|)	Std.lv
ATB	BB	0.304	0.096	3.160	0.002	0.274
ATB	PRB	0.293	0.106	2.749	0.006	0.263
ATB	LA	0.054	0.075	0.713	0.476	0.048
SN	NB	0.424	0.109	3.899	0.000	0.391
PBC	CB	0.035	0.071	0.489	0.625	0.035
BI	PRB	0.276	0.082	3.370	0.001	0.226
BI	PBC	0.335	0.107	3.128	0.002	0.274
BI	SN	0.163	0.084	1.934	0.053	0.144
BI	ATB	0.068	0.072	0.946	0.344	0.062
BI	LA	0.389	0.107	3.648	0.000	0.318
B	LA	0.256	0.083	3.083	0.002	0.235
B	BI	0.189	0.069	2.742	0.006	0.212
B	PBC	0.099	0.076	1.305	0.192	0.091
B	PRB	-0.002	0.073	-0.024	0.981	-0.002

From the SEM results in Figure 18, for the study's research model, the following null hypotheses are rejected indicating statistically significant relationships: H01 (LA->BI), H04 (PBC->BI), H05 (PRB->BI), H06 (BI->B), H08 (LA->B), H09 (PRB->ATB), H11 (BB->ATB) and H12 (NB->SN). However, the following null hypotheses are not rejected indicating relationships that are not statistically significant: H02 (ATB->BI), H03 (SN->BI), H07 (LA->ATB), H10 (PRB->B), H13 (CB->PBC) and H14 (PBC->B). Among the statistically significant relationships, Table 47 shows that the standardised estimates range in

value from 0.212 to 0.391 with the highest influence being NB on SN and the lowest influence being BI on B.

Table 47: Ranking of the standardised estimates for the statistically significant relationships

Dependent Variable	Independent Variable	Std.lv (in descending order)
SN	NB	0.391
BI	LA	0.318
ATB	BB	0.274
BI	PBC	0.274
ATB	PRB	0.263
B	LA	0.235
BI	PRB	0.226
B	BI	0.212

The preceding SEM is important for the study and for fellow researchers as it presents a method for specifying and analysing structural relationships hypothesized between theoretical constructs from the literature. As such, it has enabled the study's objective to be met and provides the required insights about which relationships among the constructs have significant influence to improve the outcome behaviour of teaching Green IT.

The SEM model is also important for education management because it emphasizes where focus and resources would be best allocated for improving the teaching of Green IT. Therefore, according to Figure 18, allocating time and resources to improve the student teachers' level of awareness (LA), perceived behavioural control (PBC) and person-related beliefs (PRB) would positively influence the student teachers' intention to teach Green IT (BI), which would, in turn, positively influence their actual behaviour of teaching Green IT (B). These are the key aspects of the research model for teaching Green IT and provides the answer to research question two.

4.10 Chapter summary and conclusions

Chapter Four reported on the implementation of the research methodology, explained in Chapter Three. The chapter objectives have been fulfilled by reporting on the data collection and handling processes, measuring reliability and validity, examining the underlying dimensionality of the questionnaire items, describing the demographics of the respondents, analysing the effects of the demographic variables, testing the study's hypotheses and evaluating the research model. Therefore, the goal of Chapter Four has been achieved, which was to present, analyse and discuss the data gathered and answer research question two.

In conclusion, Chapter Four answered the study's second research question by establishing what the key behavioural aspects are for teaching Green IT. The key aspects are level of

awareness (LA), perceived behavioural control (PBC) and person-related beliefs (PRB), which would positively influence a student teachers' intention to teach Green IT (BI), and, in turn, positively influence their actual behaviour of teaching Green IT (B).

This chapter has value for academics since it demonstrated rigorous data collection and handling processes, which enabled appropriate analyses including EFA, ANOVA and SEM for answering the study's second research question. This chapter also has value for teaching practice by explaining an analysis process for presenting the key aspects involved in teaching Green IT. Chapter Five is the next chapter. Chapter Five explains how all the research questions have been answered, the problem statement has been addressed and the research objective achieved. In addition, Chapter Five clarifies the study's research limitations, contributions and future research opportunities

Chapter 5: Research Conclusion

5.1 Chapter introduction

The previous chapter, Chapter Four, presented, analysed and discussed the data gathered and answered the study's second research question. The goal of Chapter Five is to provide the outcomes and conclusions of the research and to answer the study's third research question. To achieve this goal, Chapter Five has the following specific objectives: to present a summary of the findings from Chapter Four, demonstrate that the research problem is addressed, research questions answered and research objective achieved, discuss the research limitations, provide management guidelines and recommendations, clarify the study's contribution to the field and discuss opportunities for future research.

Chapter Five continues by providing a detailed summary of the presentation and discussion of the data and explaining how the research questions were answered, research problem addressed and research objective achieved. Then, research limitations, management guidelines and recommendations provided. Finally, contributions to the field and proposal for future research are discussed.

5.2 Summary of the presentation and discussion of the data

The objective of this study was to investigate the antecedents to teaching Green IT, in an African country, namely Swaziland, in order to understand how to improve student teachers' intention to teach Green IT and consequently their actual behaviour of teaching Green IT. Thus, the criteria used for selecting participants in this study were student teachers from teacher-training institutions in the African country of Swaziland, covering all education teaching grade ranges and qualification types and exhibiting a wide range of demographic characteristics.

The sample of the study was considered representative because it represented all education teaching grade ranges, qualification types and genders for student teachers in Swaziland. In addition, there was a wide range of the respondent demographics of age, months of practical teaching experience, teaching subject categories and year level of subjects/modules/courses. However, most of the home languages were Swazi, which was expected since the study was conducted in Swaziland.

The reliability of the questionnaire items was tested using Cronbach's alpha. The Cronbach alpha values were above 0.7, which means that they were considered reliable for the constructs in the questionnaire. In addition, the EFA showed the groupings of the items for each of the 10 constructs in the questionnaire, providing support for the study's research

model and the items used to measure each construct. The rotated matrix with factor loadings provided an indication that the questionnaire measures the intended constructs, which was further support for construct validity and suggested that the questionnaire made sense or had face validity. Also, the rotated matrix with factor loadings indicated that there were no cross-loadings and mostly high loadings, which presents support for discriminant and convergent validity, respectively.

Notably, a significant difference between the groups "early childhood grades" and "primary school grades" for the construct behavioural intention (BI) was evident. Thus, respondents intending to teach early childhood grades differed significantly from those respondents intending to teach primary school grades in their intention to teach Green IT. The respondents intending to teach early childhood grades had a lower mean of 14.138 while respondents intending to teach primary school grades had a higher mean of 15.560. The means are significantly different and additional attention via Green IT initiatives could potentially benefit student teachers intending to teach early childhood grades to help them improve their Green IT teaching.

Similar to teaching grade range, a significant difference between the groups "early childhood education diploma", "bachelor of special and inclusive education" and "primary teacher's diploma" for the construct behavioural intention (BI) was evident. Thus, respondents registered for these qualifications differ significantly in their intention to teach Green IT. The respondents registered for the primary teacher's diploma had a mean of 15.9077, respondents registered for the early childhood education diploma had a lower mean of 14.5309 and respondents registered for the bachelor of special and inclusive education had the lowest mean of 13.7857. The means are significantly different on the aforementioned pairs and additional attention via Green IT initiatives could potentially benefit student teachers registered for the early childhood education diploma and the bachelor of special and inclusive education to help them improve their Green IT teaching.

Importantly, the SEM provided evidence that the key aspects of the research model are level of awareness (LA), perceived behavioural control (PBC) and person-related beliefs (PRB), which would positively influence a student teachers' intention to teach Green IT (BI), and, in turn, positively influence their actual behaviour of teaching Green IT (B).

In relation to the literature, there is support of the results where level of awareness was an variable in an extended model based on the theory of reasoned action and it was found that level of awareness had an effect on behaviour (Mishra et al., 2014). Furthermore, it has also been found that perceived behavioural control and person-related beliefs had an effect on behavioural intention (Chow & Chen, 2009; de Leeuw et al., 2015). In addition, it was

reported that person-related beliefs were a determinant of behavioural intention and behaviour (Mishra et al., 2014).

5.3 The research question answered

Research question one was: what are the antecedent factors influencing the teaching of green IT? The study's research model, presented in Section 2.4.5.8 and developed based on substantial preceding justifications throughout Chapter Two, was an appropriate research model for analysing the behavioural drivers of teaching Green IT and, thus, answering the study's first research question. The study's research model was appropriately based on the theories of reasoned action (TRA) and planned behaviour (TPB), which were the best fit because they explain the antecedents to an individual's behaviour, which can appropriately be teaching behaviour.

Research question two was: which factors are the most significant in the teaching of Green IT? Chapter Four provided extensive and rigorous data analysis to establish that the key aspects were the student teachers' level of awareness (LA), perceived behavioural control (PBC) and person-related beliefs (PRB) that would positively influence the student teachers' intention to teach Green IT (BI), and, in turn, positively influence their actual behaviour of teaching Green IT (B). These are the key aspects of the research model for teaching Green IT and provide the answer to research question two.

Research question three was: what guidelines and recommendations can be made to college management to improve the teaching of Green IT? The answers to this research question are provided in Section 5.6 and based on the findings elaborated on in Chapter Four. They provide college management with a set of guidelines and recommendations based on empirical evidence for improving the teaching of Green IT.

5.4 The research problem addressed and research objective achieved

As justified in Section 1.4, the research problem is the lack of research focusing on the teaching of Green IT in the context of the urgent need for this and teachers' limited knowledge and competencies relating to the many aspects of environmental sustainability, which includes Green IT. Hence, addressing this research problem presents an original contribution to the academic body of knowledge. In addition, there was a lack of research in the domain from African countries. This necessitates further sustainability research in Africa because Africa is a continent that is especially vulnerable to global warming and environmental degradation (Low, 2006). In response, the study's research objective is to investigate the antecedents to teaching Green IT in an African country context, namely

Swaziland, in order to understand how to improve student teachers' intention to teach Green IT and consequently their actual behaviour of teaching Green IT.

The study has both addressed this research problem and achieved its research objective. The research problem has been addressed by conducting research and providing empirical evidence on the teaching of Green IT and especially the theoretical antecedents or behavioural drivers of teaching Green IT, which are considered vital for understanding how to improve student teachers' intention to teach Green IT, which directly influences their actual behaviour of teaching Green IT. Furthermore, the theoretical antecedents or behavioural drivers of teaching Green IT address teachers' limited knowledge and competencies relating to the many aspects of environmental sustainability, which includes Green IT. In addition, Green IT research is sustainability research and the study was conducted on an African country, which helps to address Africa's particular sustainability vulnerabilities. The outcome of the study is understanding and insight about how to improve student teachers' intention to teach Green IT and consequently their actual behaviour of teaching Green IT.

5.5 Guidelines and recommendations for college management

The study has value for teaching practice by informing teaching and curriculum design in teacher-training institutions. Specifically, it provides curriculum guidance to promote environmental sustainability in general and Green IT in particular. The study does not focus on the actual implementation of Green IT into the syllabi/curriculums of the student teachers, the actual implementation of Green IT into the syllabi/curriculums of the pupils that these teachers will teach once they graduate and start teaching or the teaching processes involved in the actual teaching of Green IT, instead the study provides college management with insight about how best to design and implement Green IT into the curriculums of the student teachers through knowledge of the most significant factors that influence student teachers to teach Green IT. College management should focus on leveraging these factors in the design and implementation of any Green IT teaching material. Furthermore, once college management incorporate Green IT into the syllabi/curriculums of the student teachers, the affected student teachers that graduate and start teaching will then be able to effectively motivate for Green IT to be incorporated into the syllabi of the subjects that they teach and/or teach Green IT as a voluntary addition to the syllabi. Both are valuable.

Following are a set of management guidelines and recommendations for college management, based on the findings from Chapter Four, to implement to improve teachers' limited knowledge and competencies relating to the many aspects of environmental sustainability,

which includes Green IT. It is recommended that teacher training institutions focus curriculums and courses in order to:

1. Increase student teachers' level of awareness (LA) of Green IT since awareness refers to having knowledge about Green IT. Formal integration of Green IT content into existing curriculums, courses and assessment may be effective and more informal methods may also increase student teachers' level of awareness through social media and events.
2. Increase student teachers' perceived behavioural control (PBC), which refers to student teacher's perceptions of the ease or difficulty of teaching Green IT. Here the focus could be on providing the student teachers with different teaching methods for teaching Green IT and providing them with opportunities to present Green IT teaching to their intended teaching grade levels.
3. Increase student teachers' person-related beliefs (PRB), which refers to student teachers' perceptions about their role in advancing the Green IT practices of others. This would require emphasising the student teachers' potential effect on the Green IT practices of the many people they could teach throughout their lives.
4. Increase student teachers' intention to teach Green IT (BI), which refers to student teachers' resolve to teach Green IT. By highlighting the importance of the natural environment for human existence, the negative effects of IT on that environment and the potential for Green IT to resolve those negative effects, student teachers' intention to teach Green IT may be increased.
5. Increase student teachers' actual behaviour of teaching Green IT (B), which refers to teaching Green IT. It is recommended that student teachers are provided with opportunities to present Green IT teaching to their intended teach grade levels, to their peers and in college events.
6. Provide additional attention to those student teachers planning to teach early childhood grades, since they differed significantly with lower mean scores from those student teachers planning to teach primary school grades in their intention to teach Green IT. Early childhood learners are pre-school learners, who are expected to have less IT devices and control over those devices and their management than children in primary school grades. Therefore, early childhood grade teachers may see less of a need to teach Green IT to these learners. However, inculcating a Green IT culture into learners may be easier and more effective long term from an early age. Highlighting this benefit and providing custom Green IT content tailored to pre-primary learners who are still learning to read and write would be necessary to improve early childhood grade teachers' intention to teach Green IT.

7. Provide additional attention to those student teachers registered for the early childhood education diploma and bachelor of special and inclusive education, since they differed significantly with lower mean scores from those student teachers registered for the primary teacher's diploma in their intention to teach Green IT. The recommendations in recommendation 6 would apply again and be necessary to improve the early childhood education diploma student teachers' intention to teach Green IT. For the student teachers registered for the bachelor of special and inclusive education, their learners could have a very wide array of disabilities, including minor, severe, physical and mental or any combination. As such, it would be practical to provide Green IT content to these student teachers that they could modify in different ways to fit each type of disability. Here the Green IT principles would be most important in addition to creative teaching methods to fit each type of learner.

5.6 Contributions to the field

In addition to providing a justified scientific process for rigorously conducting the study, addressing the research problem presents an original contribution to the academic body of knowledge by providing rigorous empirical evidence about the theoretical antecedents or behavioural drivers of teaching Green IT, which are considered vital for understanding how to improve student teachers' intention to teach Green IT, which directly influences their actual behaviour of teaching Green IT. The specific scientific insights that enhance the field are exposure of the statistically significant aspects of student teachers' level of awareness (LA), perceived behavioural control (PBC) and person-related beliefs (PRB) for positively influencing their intention to teach Green IT (BI), and, in turn, positively influencing their actual behaviour of teaching Green IT (B).

5.7 Research limitations and proposals for future research

The study had certain limitations, as is common for most research endeavours, and which provides opportunities for future research. Firstly, the study proceeded with a representative purposive sample recommended by the literature and justified in Section 3.5.1. However, such a sampling method does present limitations since it is open to subjective bias, so, inferences and conclusions drawn from the study may not be applied beyond the sample, which affects external validity or generalisability. Future research should consider implementing random sampling where practically possible to promote statistical generalisability. Also, the study was done in one African country, namely Swaziland, and it would be useful for future studies to gather and analyse empirical data from other African countries and even countries on other continents to test and verify the study's findings and for further refinement of the theory.

During SEM analysis, the Tucker-Lewis index (TLI) or non-normed fit index (NNFI) = 0.899 was just below the minimum recommended value of 0.90 required for an acceptable fit and away from the cut-off value of 0.95 (Hu & Bentler, 1999), and the standardised root mean squared residual (SRMR) = 0.110 was above the maximum recommended value of 0.08 required for an acceptable fit and above the cut-off value of 0.09 (Hu & Bentler, 1999). This indicates that there may be other models, statistically, that could provide better fits than the SEM model fitted for the SEM analysis in this study. This provides opportunities for future research. The covariance matrix for the study's dataset is provided in Appendix F so that the SEM processing can be replicated and alternative models tested on the same data, but this would still require ample complementary theoretical justification to support any alternative model.

In addition, the study was conducted at one point in time, which provides a snapshot at a specific time and does not analyse behaviour over time. Future research could be conducted on a longitudinal basis, which is research conducted over time, usually long time periods. Such longitudinal studies could provide useful insights about changes in the research model's constructs, interrelationships and patterns over time and developmental trends in Green IT teaching behaviour.

5.8 Chapter summary and conclusions

Chapter Five explained how all the research questions were answered, the problem statement was addressed and the research objective achieved. In addition, Chapter Five clarified the study's research limitations, contributions and future research opportunities. The chapter objectives have been fulfilled by presenting a summary of the findings from Chapter Four, demonstrating that the research problem was addressed, research questions answered and research objective achieved, discussing the research limitations, providing management guidelines and recommendations, clarifying the study's contribution to the field and discussing opportunities for future research. Therefore, the goal of Chapter Five has been achieved, which was to provide the outcomes and conclusions of the research and to answer the study's third research question.

In conclusion, Chapter Five answered the study's third research question by presenting a set of guidelines and recommendations for college management to improve the teaching of Green IT. In addition, Chapter Five explained how the study addressed the identified research gap as explained in Chapter One. By addressing the research problem, the study also helps to addresses the world-wide problem of environmental degradation and especially IT's

contribution to environmental degradation, which are both relevant, substantial and significant problems.

This chapter has value for academics since it explains how this study has developed new knowledge about the theoretical antecedents or behavioural drivers of teaching Green IT, which are considered vital for understanding how to improve student teachers' intention to teach Green IT, which directly influences their actual behaviour of teaching Green IT.

This chapter also has value for teaching practice by providing a set of management guidelines and recommendations for improving student teachers' intention to teach Green IT and consequently their actual behaviour of teaching Green IT. In addition, it assists by informing teaching and curriculum design in teacher-training institutions, specifically, it provides curriculum guidance to promote environmental sustainability in general and Green IT in particular.

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Appendix A: Initial Green IT Literature Search

The table below is sorted by participant type, being students, industry professionals or not applicable (n/a), and then by publication year.

#	Article	Year	Title of Article	Conceptual Focus	Participants	Participant Location
1	Klimova et al. (2016) - Journal of Cleaner Production	2016	An International Master's Program in Green ICT as a Contribution to Sustainable Development	Development of a master's degree program focusing on ICT and sustainability	Students	France
2	Shittu, Gambari and Alabi (2016) - Journal of Education and Learning	2016	Survey of Education, Engineering, and Information Technology Students' Knowledge of Green Computing in Nigerian University	Green Computing knowledge	Education, Engineering and IT Students	Nigeria
3	Chen et al. (2015) - Journal of Computer Information Systems	2015	Investigating Users' Extrinsic Motivation for Green Personal Computing	Users' extrinsic motivations for personal Green computing	General university students	Hong Kong
4	Birchi (2015) - Proceedings of 2015 International Conference on Future Computational Technologies	2015	Assessing University Students' Attitude toward Green Computing Practices	Attitudes towards Green computing	General university students	Nigeria
5	Issa, Issa and Chang (2014) - The International Journal of Sustainability Education	2014	Sustainability and Green IT Education: Practice for Incorporating into the Australian Higher Education Curriculum	Awareness of sustainability and Green IT	Master's degree IS university students	Australia
6	Bandi et al. (2015) - Proceedings of the 2015 ACM SIGMIS Conference on Computers and People Research	2014	Exploring Green IT Awareness and Adoption among Indian Students	Green IT awareness and adoption	General university and college students	India
7	Ahmad and Nordin (2014) - International Education Studies	2014	University students' subjective knowledge of Green computing and pro-environmental behaviour	Subjective knowledge of Green Computing	General undergraduate university students	Malaysia

#	Article	Year	Title of Article	Conceptual Focus	Participants	Participant Location
8	Choon et al. (2014) - International Journal of Research in Business and Technology	2014	Intention to Use Green IT among Students	Green IT intentions	Students in the business faculty of Malaysia Institute of higher learning	Malaysia
9	Chiyangwa (2014) – Master's degree dissertation	2014	Belief and Actual Behaviour in Green Information Technology within a South African Tertiary Institution	Green IT beliefs and behaviour and factors contributing to Green IT awareness	University IT students and lecturers	South Africa
10	Ahmad et al. (2013) - International Journal on Education(JEd)	2013	Exploring Malaysian University Students' Awareness of Green Computing	Awareness of Green Computing	General university students	Malaysia
11	Din, Haron and Ahmad (2013) - Procedia - Social and Behavioural Sciences	2013	The Level of Awareness on the Green ICT Concept and Self-Directed Learning among Malaysian Facebook Users	Green ICT level of awareness	Student adult learners	Malaysia
12	Worthington (2012) - Computer Science & Education (ICCSE), 2012 7th International Conference on	2012	A Green Computing Professional Education Course Online: Designing And Delivering A Course In ICT Sustainability Using Internet And eBooks	Green computing course design and delivery	University students and industry based participants	Australia
13	Batlegang (2012) - Journal of Information Systems and Communication	2012	Green Computing: Students, Campus Computing And The Environment-A Case For Botswana	Awareness of Green Computing	General college students and academic employees	Botswana
14	Ramachandiran (2012) - 2012 IEEE Symposium on Business, Engineering and Industrial Applications	2012	Green ICT Practices among Tertiary Students: A Case Study	Green ICT practice	Private higher education institution (HEI) students	Malaysia
15	Dookhitram et al. (2012) - Conference Proceeding of International Conference on Higher Education and Economic Development	2012	Green Computing: An Awareness Survey among University of Technology, Mauritius Students	Green computing Awareness	Technologies and engineering university students	Mauritius

#	Article	Year	Title of Article	Conceptual Focus	Participants	Participant Location
16	Issa, Issa and Chang (2011) - The International Journal of Environmental, Cultural, Economic & Social Sustainability	2011	Would Teaching Sustainable Development Business Strategies Shift Students' Mindsets? An Australian Experience	Green IT and sustainability	General post graduate students	Australia
17	Coleman, Bahnam and Curry (2011) - The Journal of Applied Business Research	2011	Walking The Walk: How The Theory Of Reasoned Action Explains Adult And Student Intentions To Go Green	Green consumption behaviour and intentions	Business students and adult non-students	United States of America
18	Chow and Chen (2009) - Journal of Computer Information Systems	2009	Intended Belief and Actual Behaviour in Green Computing in Hong Kong	Green computing belief and behaviour	General university students	Hong Kong
19	Ainin, Naqshbandi and Dezdar (2016) - Quality & Quantity	2016	Impact of Adoption of Green IT Practices on Organizational Performance	Green IT adoption and impact	IT managers	Iran
20	Akman and Mishra (2015) - Computers in Human Behaviour	2015	Sector Diversity in Green Information Technology Practices: Technology Acceptance Model Perspective	Analysis of sector diversity in	Public and Private sector professionals	Turkey
21	Molla et al. (2014) - Information Technology & People	2014	Green IT Beliefs and Pro-environmental IT Practices among IT Professionals	Green IT beliefs and attitude	IT professionals	Australia
22	Lei and Ngai (2014) - Pacific Asian Conference on Information Systems (PACIS)	2014	A Research Agenda on Managerial Intention to Green IT Adoption: From Norm Activation Perspective	Green IT adoption	Managers	China
23	Ahmaro et al. (2014) - 6th International Conference on Information Technology and Multimedia at UNITEN	2014	The Current Practices of Green Computing Approaches in Malaysia	Types of Green computing initiatives	IT industry	Malaysia
24	Savita, Ominic and Ramayah (2014) - 2014 International Conference on Computer and Information Sciences (ICCOINS)	2014	The Adoption of Green Information Technologies and Systems as a Driver within Green SCM	Green IT/IS and supply chain management	Manufacturing companies' employees	Malaysia

#	Article	Year	Title of Article	Conceptual Focus	Participants	Participant Location
25	Mishra et al. (2014) - Problems of Sustainable Development	2014	Green Information Technology Practices among IT Professionals: Theory of Planned Behaviour Perspective	Green IT practices	IT professionals	Turkey
26	Mishra and Akman (2014) - Environmental Engineering and Management Journal	2014	Green Information Technology & Gender Diversity	Green IT and Gender diversity	IT professionals from public and private institutions	Turkey
27	Molla and Abareshi (2011) - Pacific Asia Conference on Information Systems (PACIS)	2011	Green IT Adoption: A Motivational Perspective	Motivations for adopting Green IT	IT managers and chief information officers (CIOs) from business and government organisations	Australia
28	Ansari et al. (2010) – Proceedings of the International Symposium on Technology and Society	2010	Green IT Awareness and Practices: Results from a Field Study on Mobile Phone Related E-waste in Bangladesh	Awareness and practices of Green IT	IT professionals, mobile phone repair shop employees, and general users	Bangladesh
29	Capra and Caleffi (2010) - Pan Pacific Microelectronics Symposium & Tabletop Exhibition	2010	A Survey on IT Managers Green Awareness	Green IT awareness	IT managers	Italy
30	Asabere, Acakpovi and Quaynor (2016) - International Journal of Applied Information Systems	2016	Encouraging Green ICT Implementation Strategies in Polytechnic Education in Ghana	Green ICT strategies	N/a – discussion paper	N/a
31	Hernandez and Ona (2016) - International Journal of Social Ecology and Sustainable Development (IJSESD)	2016	Green IT Adoption: Lessons from the Philippines Business Process Outsourcing Industry	Practices, processes and enablers in Green IT adoption	N/a – discussion paper	N/a
32	Wang, Deng and Ji (2015) - International Conference on Information Resources Management (CONF-IRM)	2015	Why Organizations Adopt Green IT: A Comprehensive Review	Predictors of Green IT adoption	N/a - discussion paper	N/a

#	Article	Year	Title of Article	Conceptual Focus	Participants	Participant Location
33	Esfahani, Rahman and Zakaria (2015) - Journal of Soft Computing and Decision Support Systems,	2015	The Status Quo And The Prospect Of Green IT And Green IS: A Systematic Literature Review	Green IT and Green IS	N/a - systematic literature review	N/a
34	Saha (2014) - International Journal of Computing Trends and Technology (IJCTT)	2014	Green Computing	Green computing issues and approaches	N/a – discussion paper	N/a
35	Ranbhise (2014) - Contemporary Computing and Informatics (IC3I), 2014 International Conference on (IC3I)	2014	Green Computing: A Way Towards Environmentally Sustainable Future	Small business Green strategy implementation model	N/a - conceptual research	N/a
36	Foogooa and Dookhitram (2014) - 2014 IST-Africa Conference Proceedings	2014	A Self Green ICT Maturity Assessment Tool for SMEs	Green ICT maturity assessment tools	N/a - conceptual research	N/a
37	Banerjee, Sing, Chowdhury and Anwar (2013) - International Journal of Green Computing (IJGC)	2013	Motivations to adopt Green ICT: A Tale Of Two Organizations	Motivations for adopting Green ICT	N/a – secondary research	N/a
38	Vikram, Shalini and Prasanti (2013) - Journal of Telematics and Informatics (JTI)	2013	Green Computing	Green computing approaches	N/a – discussion paper	N/a
39	Harbla, Aditya and Negi (2013) - International Journal of Advanced Research in Computer Science and Software Engineering	2013	Green Computing Research Challenges: A Review	Green computing initiatives	N/a – discussion paper	N/a
40	Lay, Ahmad and Ming (2013) - Malaysian Online Journal of Educational Management	2013	The Barriers To Adoption of Green Technology By Higher Education Institutions in Malaysia	Green Technology adoption barriers.	N/a – discussion paper	N/a
41	Trimi and Park (2013) - Service Business	2013	Green IT: Practices Of Leading Firms And NGOs	Green IT practices	N/a – discussion paper	N/a

#	Article	Year	Title of Article	Conceptual Focus	Participants	Participant Location
42	Agarwal, Vimal, Ghosh and Nath (2012) - Journal of Computing	2012	Green Computing Endeavour in Higher Educational Institutes–a noble initiative towards Sustainable IT Infrastructure	Green computing initiatives	N/a – discussion paper	N/a
43	Chou and Chou (2012) - Computer Standards & Interfaces	2012	Awareness of Green IT and its Value Model	Green IT value model	N/a - conceptual paper	N/a
44	Raza, Patle and Arya (2012) - Journal of Computational Intelligence and Electronic Systems	2012	A Review on Green Computing for Eco-Friendly and Sustainable IT	Green Computing awareness	N/a – discussion paper	N/a
45	Cai, Chen and Bose (2012) - International Journal of Business Data Communications and Networking (IJBDCN)	2012	The Many Faces of Green IT	Green IT	N/a – discussion paper	N/a
46	Agarwal and Nath (2011) - International Conference on Communication Systems and Network Technologies, CSNT 2011	2011	Green Computing – a new Horizon of Energy Efficiency and Electronic Waste Minimization": A Global Perspective	Best practices of Green computing	N/a – discussion paper	N/a
47	Deng et al. (2011) - Computer Science for Environmental Engineering and Ecoinformatics	2011	Trends and Development on Green Computing	Tools of Green computing	N/a – discussion paper	N/a
48	Jenkin et al. (2011) - Information and Organization	2011	An Agenda for 'Green' Information Technology and Systems Research	Green IT research framework	N/a - literature review and conceptual research	N/a
49	Chai-Arayalert and Nakata (2011) - 2011 IEEE/ACM International Conference on Green Computing and Communications	2011	The Evolution of Green ICT Practice: UK Higher Education Case Study	Green ICT practice	N/a – discussion paper	N/a
50	Gupta (2010) - Proceedings of the International Conference and Workshop on Emerging Trends in Technology - ICWET '10	2010	Computing With Green Responsibility	Green computing approaches	N/a – discussion paper	N/a

#	Article	Year	Title of Article	Conceptual Focus	Participants	Participant Location
51	Jena (2010) - World Summit on Knowledge Society	2010	Green Computing: Need of the Hour	Green computing initiatives	N/a – discussion paper	N/a
52	Brooks et al. (2010)- Americas Conference on Information Systems (AMCIS)	2010	Unpacking Green IT: A Review of the Existing Literature	Status of Green IT research	N/a - literature review	N/a

Appendix B: Literature Review-Concept-Centric Literature Matrix

	Concepts / Author, year, publication	Total per references	Environmental sustainability and related concepts	Student teachers, teachers and sustainability	Green IT	students' awareness of and attitudes and intentions toward Green IT	Applicable theories, frameworks and models	Constructs
	Total per concept	125 / 126	**16**	**28**	**27**	**19**	**28**	**8**
1.	Batlegang (2012) – Journal of Information Systems and Communications	**2**			1	1		
2.	Boubonari et al. (2013)- Journal of Environmental Education	**1**		1				
3.	Selyamani and Ahmad (2015) - Journal of Consumer Research	**2**			1	1		
4.	Ahmad et al. (2013) - GSFT International Journal on Education	**1**			1			
5.	Karpudewan et al. (2013)- Asian Pacific Journal of educators and education	**1**		1				
6.	Florian et al. (1999)- Journal of Environmental Education	**1**					1	
7.	Evans et al. (2012)–Australian Journal of Teacher Education	**1**		1				
8.	Kartiwi et al. (2014)- Journal of Applied Sciences	**2**		1	1			
9.	Ramachandiran (2012)- IEEE Symposium on Business, Engineering and Industrial Applications	**2**			1	1		
10.	Hostovský (2014)-Encyclopaedia of Quality of Life and Well-Being Research	**1**	1					
11.	Tal (2010)- International Research in	**1**		1				

	Geographical and Environmental Education							
12.	Çakır et al. (2010)- Educational Studies	**1**		1				
13.	Sureda-Negre et al. (2014)– International Research in Geographical and Environmental Education	**1**		1				
14.	Álvarez-García et al. (2015)- Journal of Teacher Education for Sustainability	**1**		1				
15.	OECD (2001)- Organisation for Economic Co-operation and Development	**1**	1					
16.	Tedre et al. (2009)- Proceedings of the 39th IEEE Frontiers in Education Conference	**1**		1				
17.	Esa (2010)- International Research in Geographical and Environmental Education	**1**		1				
18.	Candan and Erten (2015)- International Electronic Journal of Environmental Education	**1**		1				
19.	Erten and Aydoğdu (2011) - Hacettepe University Faculty of Education Journal	**1**		1				
20.	Effeney and Davis (2013)- Australian Journal of Teacher Education	**1**		1				
21.	Özden (2008)- International Research in Geographical and Environmental education	**1**		1				
22.	Boon and Wilson (2011)- Proceedings of Australian Teacher Education Association Conference	**1**		1				
23.	Burmeister (2013)- Science Education Internationally	**1**		1				
24.	Chen et al. (2015)– Journal of Computer Information Systems	**2**				1	1	
25.	Molla et al. (2014)- Information Technology and People	**1**				1		
26.	Chiyangwa (2015)- University of South Africa	**1**				1		
27.	Gupta (2010)- International Conference and Workshop on Emergency Trends in Technology	**1**			1			
28.	Ahmaro et al. (2014)- Proceedings of 6th International Conference on Information Technology and Multimedia at UNITEN: Cultivating Creativity and Enabling Technology Through the Internet of Things, ICIMU 2014	**1**			1			
29.	Saha (2014)- International Journal of Computing Trends and Technology(IJCTT)	**1**			1			

30.	Tushi (2015) - Queensland University	**1**			1			
31.	Murugesan (2008) - IT Professional	**1**			1			
32.	Venkat et al. (2015) - Journal of Information Sciences & Computing Technologies	**1**			1			
33.	Bezáková (2013)- Advances in Information and Communication Technology	**1**			1			
34.	Jena (2010) – Organisation, Business, and Technological Aspects of the Knowledge Society: Third World Summit on the Knowledge Society	**1**			1			
35.	Mogotlhwane (2014) - International Journal of Digital Information and Wireless Communications	**1**			1			
36.	Chou and Chou (2012)- Computer Standards and Interfaces	**1**		1				
37.	Beckford (2008) - Journal of Teaching and learning	**1**		1				
38.	Zhang and Liang (2012)- Telecommunications Policy	**1**			1			
39.	Özden (2008) -International Research in Geographical and Environmental Education	**1**		1				
40.	Kimppa et al. (2014)-ICT and Society: 11 the IFIP TC 9 International Conference on Human Choice and Computers, HCC11 2014	**1**			1			
41.	Murugesan & Laplante (2011) - IT Professional	**1**			1			
42.	Brooks et al. (2012) – Green Business Process Management	**1**			1			
43.	Samuri (2014)- International Conference on Green Computing, Technology & Innovation (IJCTT)	**1**			1			
44.	Ansari et al. (2010) – Proceedings of the International Symposium on Technology and Society	**1**			1			
45.	Redman (2013)- Journal of Teacher Education for Sustainability	**1**		1				
46.	Wheeler and Bryne (2003)- Planning for Higher Education	**1**		1				
47.	Wu (2002)- Journal of Environmental Education	**1**		1				
48.	Tomas and Mills (2011)- Proceedings of the Australian Teacher Educators' Association	**2**		1	1			
49.	Mutherbaugh and Kern (2012)- Journal of	**1**		1				

	Teachers Education for Sustainability							
50.	Roodt and de Villiers (2012)- International Journal of Innovation in the Digital Economy	**1**			1			
51.	Abbate (2015)- Balboa Press	**2**			1			1
52.	Sheppard et al. (1988) - Journal of Consumer Research	**1**					1	
53.	Sharma and Romas (2012)- Jones and Bartlett Learning	**1**		1				
54.	Seitz et al.(2010)- Globalization and Higher Education in Economics and Business Administration	**1**				1		
55.	Jenkin et al. (2011)- Information and Organization	**1**				1		
56.	Amel et al. (2009)- Ecopsychology	**1**				1		1
57.	Mishra et al. (2014)- Computers in Human Behaviour	**3**				1	1	1
58.	Hanks et al. (2008)- Proceedings of the 26th International SIGHCHI Conference on Human Factors in Computing Systems	**1**				1		
59.	Dookhitram et al. (2012)-Conference Proceeding of International Conference on Higher Education and Economic Development	**2**			1	1		
60.	Ajzen and Fishbein (1980)- Prentice- Hall Inc.	**2**				1		1
61.	Newhouse (1990)- International Research in Geographical and Environmental education	**2**		1		1		
62.	Hines et al. (1986) - Journal of environmental Education	**1**				1		
63.	Birchi (2015)-Proceedings of 2015 International Conference on Future Computational Technologies (ICFT'2015)	**1**				1		
64.	Li and Zhou (2011) - ACM Digital Library	**1**			1			
65.	Bandi et al. (2015) - ACM Digital Library	**1**			1			
66.	Charalabidis and Koussouris (2012)- Springer-Verlag Berling Heidelberg	**1**					1	
67.	Bamberg et al. (2003)- Basic and Applied Psychology	**1**					1	
68.	Phunde et al. (2014)- Journal of Management and Research	**1**			1			

69.	Taylor & Todd (1995b) - Information Systems Research	**2**					1	1
70.	Chen et al. (2015)- Journal of Computer Information Systems	**2**				1	1	
71.	Lee (2008)- Michigan State University	**1**					1	
72.	Fishbein and Ajzen (1975)- Addison Wesley	**2**				1		1
73.	Babbie (2007) –Cengage Learning	**1**					1	
74.	Gratton & Jones (2004)- International Conference and Workshop on Emerging Trends in Technology	**1**					1	
75.	Chow and Chen (2009) - Journal of Computer Information Systems	**4**		1		1	1	1
76.	Ajzen (1991)- Organizational Behaviour and Human Decision Processes	**2**					1	1
77.	Kocsis (2010)- Atlantic Publishing Company	**1**	1					
78.	White (2013) - ABC-CLIO	**1**	1					
79.	Howard ans Lubbe (2012)- ACM Digital Library	**1**	1					
80.	Molla et al. (2011)- Communications of Associations of Information systems	**1**	1					
81.	Moldan et al. (2012)- Ecological Indicators	**1**	1					
82.	Sutton (2004)- Victorian Commissioner for Environmental Sustainability	**1**	1					
83.	Holden et al. (2014)-Global environmental Change	**1**	1					
84.	Hopwood et al. (2005)-Sustainable development	**1**	1					
85.	Lim and Dubinsky (2005)- Psychology & Marketing	**1**					1	
86.	Ajzen (1989) - Lawrence Erlbaum Associates	**1**					1	
87.	Sands (1995)- Manchester University Press	**1**	1					
88.	Heskett (2010) - Teacher Created Resources	**1**	1					
89.	Miller (2010)- Computers in Human Behaviour	**1**	1					
90.	Huesemann and Huesemann (2011) - New Society Publishers	**2**	1	1				
91.	Johnson et al. (1997)- Journal of Environmental Quality	**1**	1					
92.	Gay (2012) – Scarecrow Press, Inc.	**1**	1					

93.	Bosworth et al. (2006)- Lawrence Erlbaum Associates	**1**					1	
94.	Beadnell et al. (2008)- Journal of Applied Social Psychology	**1**					1	
95.	Butler (1999)- Journal of Research in Science Teaching	**1**					1	
96.	Crosby and Muehling (1983)- Advances in Consumer Research	**1**					1	
97.	Yagmaei (2010)- Handbook of Research on Information Technology Management and Clinical Data Administration in Healthcare	**1**					1	
98.	Timothy and Peggy (2013)- Journal of research on Technology in Education	**1**					1	
99.	Rogers (1995)- The Free Press	**1**					1	
100.	Hernandez & Mazzon (2007)- Journal of Research on Technology in Education	**1**					1	
101.	Fang and Shih (2004)- Internet Research: Electronic Networking Applications and Policy	**1**					1	
102.	Md Husin and Ab Rahman (2016) - International Journal of Social Economic	**1**					1	
103.	Tenhunen (2011)- Aalto University	**1**					1	
104.	Melville (2010)- MIS Quarterly	**1**					1	
105.	Thomson and Belle (2015)- Electronic Journal Information Systems Evaluation Volume	**1**					1	

Appendix C: Research Instrument-Information to Participants and Questionnaire

C.1 Participant Information Sheet

The participant information sheet has been removed from this appendix to maintain participant anonymity

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C.2 Cover letter to the online anonymous web-based survey

Dear prospective participant,

You are invited to participate in a survey conducted by Ricky Nhlanhla Dlamini (student number 43572774) under the supervision of Dr Grant Howard, a senior lecturer in the Unisa School of Computing towards a Master of Science in Computing degree at the University of South Africa (Unisa).

The survey you have received has been designed to study the factors involved in teaching Green Information Technology (Green IT). You were selected to participate in this survey because you are representative of the main categories of student teachers to which the research problem relates. Kindly note that you will not be eligible to complete the survey if you are younger than 18 years. By completing this survey, you agree that the information you provide may be used for research purposes, including dissemination through peer-reviewed publications and conference proceedings.

It is anticipated that the information we gain from this survey will help us to investigate the factors involved in teaching Green IT in an African country context, in order to understand how to improve the teaching of Green IT. You are, however, under no obligation to complete the survey and you can withdraw from the study prior to submitting the survey. The survey is developed to be anonymous, meaning that we will not connect the information that you provide to you personally. Consequently, you will not be able to withdraw from the study once you have clicked the send button based on the anonymous nature of the survey. Any identifying information that is obtained in connection with this survey will remain confidential and will be disclosed only with your permission or as required by law. If you choose to participate in this survey, it will take up no more than about fifteen of your time. You will not benefit from your participation as an individual, however, it is envisioned that the findings of this study will help to improve the teaching of Green IT. We do not foresee that you will experience any negative consequences by completing the survey. The researcher undertakes to keep any information provided herein confidential, not to let it out of his possession and to report on the findings from the perspective of the participating group and not from the perspective of an individual.

The records will be kept for five years for audit purposes where after it will be permanently destroyed. There are no anticipated costs on the part of your participation, other than fifteen

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minutes of your time at most. As such, you will not receive any incentives for your participation in the survey. However, your participation is greatly valued and has the potential to benefit future generations.

The research was reviewed and approved by the Unisa School of Computing's Ethics Review Committee. The primary researcher, Ricky Nhlanhla Dlamini (student number 43572774), can be contacted during office hours at +27 (0) 60 308 3151. The study leader, Dr Grant Howard, can be contacted during office hours at +27 (0) 11 471 2273. Should you have any questions regarding the ethical aspects of the study, you can contact the chairperson of the Unisa School of Computing's Ethics Research Committee, Dr Adele da Veiga on +27 (0) 11 670 9175. Alternatively, you can report any serious unethical behaviour at the University's Toll Free Hotline 0800 86 96 93.

You are making a decision whether or not to participate by continuing to the next page. You are free to withdraw from the study at any time prior to clicking the send button.

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C.3 Questionnaire

Investigating the Antecedents to Teaching Green Information Technology (Green IT): A Survey of Student Teachers in Swaziland

Ethical clearance #: 099/RND/2017/CSET_SOC

Survey Questionnaire

FOR RESEARCHER USE ONLY: Respondent Code: _____

VOLUNTARY QUESTIONNAIRE FOR STUDENT TEACHERS

"**Investigating the Antecedents to Teaching Green Information Technology (Green IT): A Survey of Student Teachers in Swaziland**"

School of Computing
University of South Africa (UNISA)
Researcher: Ricky Nhlanhla Dlamini (student number 43572774)
Research Supervisor: Dr Grant Howard

Note to the respondent:

- ☞ I need your help to understand the factors involved in teaching Green Information Technology (Green IT).
- ☞ Although I would like you to help me, you do not have to take part in this survey.
- ☞ If you do not want to take part, just return the blank questionnaire or let me know. If I do not hear from you, I may send you a reminder.
- ☞ What you say in this questionnaire will remain private and confidential. No one will be able to trace your responses back to you as a person.

This questionnaire has two sections:

Section A: Asks general personal particulars like your age and gender.

Section B: Asks you to give your opinion about Green IT and related matters.

Thank you very much for filling in this questionnaire.

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Section A: *Please tell me a little about yourself*

Directions for Section A:

- *Please respond by clicking the appropriate radio button or filling in words or numbers.*

1. I am:
   - ❑ Male
   - ❑ Female
   - ❑ I do not want to answer this question
   - ❑ Other: _____

2. My home language is:
   - ❑ Swazi
   - ❑ Ndebele
   - ❑ Northern Sotho
   - ❑ Sotho
   - ❑ Tsonga
   - ❑ Tswana
   - ❑ Venda
   - ❑ Xhosa
   - ❑ Zulu
   - ❑ Afrikaans
   - ❑ English
   - ❑ I do not want to answer this question
   - ❑ Other: _____

3. I am _____ years old. (leave blank if you do not want to answer this question)

4. This year, most of my subjects/modules/courses are:
   - ❑ First year subjects/modules/courses
   - ❑ Second year subjects/modules/courses
   - ❑ Third year subjects/modules/courses
   - ❑ I do not want to answer this question
   - ❑ Other: _____

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5. When I start teaching, I want to teach the following teaching grade range:
   - ❑ Early childhood grades
   - ❑ Primary school grades
   - ❑ Secondary school grades
   - ❑ I do not want to answer this question
   - ❑ Other: _____

6. When I start teaching, I want to teach the following subject category:
   - ❑ Languages
   - ❑ Mathematics
   - ❑ Physical Education
   - ❑ Arts
   - ❑ Special Education
   - ❑ Computers
   - ❑ Social Science
   - ❑ Natural Science
   - ❑ I do not want to answer this question
   - ❑ Other: _____

7. This year, I am registered for the following qualification:
   - ❑ Early childhood education diploma
   - ❑ Primary teacher's diploma
   - ❑ Secondary teacher's diploma
   - ❑ Diploma in music education
   - ❑ Bachelor of special and inclusive education
   - ❑ I do not want to answer this question
   - ❑ Other: _____

8. So far, I have _____ months of practical teaching experience. (leave blank if you do not want to answer this question)

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Section B: *Please give me your opinion about Green IT and related matters*

Directions for Section B:

- *There are no right or wrong answers; we are only interested in your personal opinion.*
- *All the questions are in the same format and for each question you are required to read the question and then just click one of the radio buttons that best describes your opinion.*
- *Please **answer every question** otherwise the study may fail.*
- *Please only choose **one answer** for **each question** (never choose more than one answer on a question).*
- *Some of the questions may seem similar, but they do address slightly different aspects.*
- *Here is an example. In this example, the respondent has said that he/she agrees that books are important by marking the "agree" column with an "X":*

Statements about books	**Strongly disagree**	**Disagree**	**Neither disagree nor agree**	**Agree**	**Strongly agree**
Concept: Attitude toward books					
I think that books are important.				**X**	

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Here are the questionnaire items for you to answer:

Statements about Green IT and related	**Strongly disagree**	**Disagree**	**Neither disagree nor agree**	**Agree**	**Strongly agree**
Attitude toward behaviour (ATB)					
1. Teaching Green IT is good.					
2. Teaching Green IT is valuable.					
3. Teaching Green IT is useful.					
4. Teaching Green IT is worthwhile.					
Subjective Norm (SN)					
5. Most people who are important to me would approve of me teaching Green IT.					
6. Most people who are important to me would appreciate me teaching Green IT.					
7. Most people whose opinions I value would approve of me teaching Green IT.					
8. Most people whose opinions I value would appreciate me teaching Green IT.					
Perceived behavioural control (PBC)					
9. I am confident that I can teach Green IT.					
10. I am sure that I can teach Green IT.					
11. I am certain that I can teach Green IT.					
12. I am positive that I can teach Green IT.					
Behavioural beliefs (BB)					
13. I believe that teaching Green IT would help others to decrease energy consumption.					
14. I believe that teaching Green IT would help others to decrease carbon emissions.					
15. I believe that teaching Green IT would help others to decrease pollution.					
16. I believe that teaching Green IT would help others to decrease electronic waste.					
Normative beliefs (NB)					
17. I believe that school management would expect me to teach Green IT.					

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Statements about Green IT and related	**Strongly disagree**	**Disagree**	**Neither disagree nor agree**	**Agree**	**Strongly agree**
18. I believe that educators would require me to teach Green IT.					
19. I believe that education professionals would want me to teach Green IT.					
20. I believe that schools would expect me to teach Green IT..					
Control beliefs (CB)					
21. I believe that I am in control of whether I teach Green IT.					
22. I believe that I decide whether I teach Green IT.					
23. I believe that I choose whether I teach Green IT.					
24. I believe that I determine whether I teach Green IT.					
Behavioural intention (BI)					
25. I intend to teach Green IT.					
26. I aim to teach Green IT.					
27. I plan to teach Green IT.					
28. I strive to teach Green IT.					
Level of awareness (LA)					
29. I know about Green IT.					
30. I am informed about Green IT.					
31. I am aware of Green IT.					
32. I have learnt about Green IT.					
Person-related beliefs (PRB)					
33. I believe that student teachers have a role to play in promoting Green IT practices.					
34. I believe that student teachers have a role to play in advancing Green IT practices.					
35. I believe that student teachers have a role to play in progressing Green IT practices.					
36. I believe that student teachers have a role to play in furthering Green IT practices.					
Behaviour (B)					
37. I teach Green IT.					
38. I instruct Green IT.					
39. I lecture Green IT.					
40. I coach Green IT.					

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Thank you for helping me with this survey

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Appendix D: Permission Letters from Participating Institutions

The signed permission letters have been removed from this appendix to maintain participant anonymity

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Appendix E: Unisa Ethics Clearance Certificate

UNISA university of south africa

UNISA COLLEGE OF SCIENCE, ENGINEERING AND TECHNOLOGY'S (CSET) RESEARCH AND ETHICS COMMITTEE

08 December 2017

Ref #: 099/RND/2017/CSET_SOC
Name: Mr Ricky Nhlanhla Dlamini
Student #: 43572774

Dear Mr Ricky Nhlanhla Dlamini

Decision: Ethics Approval for 3 years
(Humans involved)

Researcher: Mr Ricky Nhlanhla Dlamini
P. O. Box 37, Piet Retief, 2380
43572774@mylife.unisa.ac.za
+27 60 308 3151 / +26 (0)87 642 0933

Supervisor(s): Dr G. R. Howard, howargr@unisa.ac.za, +27 11 471 2273

Proposal: Investigating the Antecedents to Teaching Green Information Technology (Green IT): A survey of Student Teachers in Swaziland

Qualification: MSc in Computing

Thank you for the application for research ethics clearance by the Unisa College of Science, Engineering and Technology's (CSET) Research and Ethics Committee for the above mentioned research. Ethics approval is granted for a period of three years, from 08 December 2017 to 08 December 2020.

1. The researcher will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should

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Appendix F: Research Data-Covariance Matrix from lavaan

Column 1	cov.ATB1	cov.ATB2	cov.ATB3	cov.ATB4	cov.SN1	cov.SN2	cov.SN3	cov.SN4
ATB1	0.39932265	0.17301845	0.15077239	0.18814387	0.01704500	0.01722001	0.02034477	0.01956189
ATB2	0.17301845	0.38776774	0.16465054	0.20546195	0.01861394	0.01880506	0.02221744	0.02136250
ATB3	0.15077239	0.16465054	0.34555550	0.17904443	0.01622063	0.01638717	0.01936081	0.01861579
ATB4	0.18814387	0.20546195	0.17904443	0.56582315	0.02024119	0.02044901	0.02415971	0.02323003
SN1	0.01704500	0.01861394	0.01622063	0.02024119	0.67638908	0.31941337	0.37737441	0.36285283
SN2	0.01722001	0.01880506	0.01638717	0.02044901	0.31941337	0.68000026	0.38124909	0.36657840
SN3	0.02034477	0.02221744	0.01936081	0.02415971	0.37737441	0.38124909	0.67745567	0.43309805
SN4	0.01956189	0.02136250	0.01861579	0.02323003	0.36285283	0.36657840	0.43309805	0.66972393
PBC1	0.00024477	0.00026730	0.00023293	0.00029067	0.00030974	0.00031292	0.00036970	0.00035547
PBC2	0.00026009	0.00028403	0.00024751	0.00030886	0.00032912	0.00033250	0.00039283	0.00037772
PBC3	0.00021685	0.00023681	0.00020636	0.00025751	0.00027440	0.00027722	0.00032752	0.00031492
PBC4	0.00021306	0.00023267	0.00020276	0.00025301	0.00026961	0.00027237	0.00032180	0.00030942
BB1	0.05740308	0.06268686	0.05462682	0.06816700	0.02174359	0.02196684	0.02595297	0.02495428
BB2	0.08132933	0.08881545	0.07739589	0.09657977	0.03080656	0.03112287	0.03677045	0.03535550
BB3	0.07440822	0.08125727	0.07080952	0.08836086	0.02818493	0.02847432	0.03364130	0.03234676
BB4	0.06073466	0.06632510	0.05779727	0.07212330	0.02300555	0.02324176	0.02745923	0.02640259
NB1	0.05076359	0.05543623	0.04830845	0.06028251	0.14367934	0.14515456	0.17149443	0.16489523
NB2	0.05435340	0.05935647	0.05172464	0.06454546	0.15383979	0.15541934	0.18362187	0.17655599
NB3	0.05760595	0.06290840	0.05481988	0.06840791	0.16304568	0.16471974	0.19460994	0.18712123
NB4	0.05506551	0.06013413	0.05240231	0.06539111	0.15585533	0.15745557	0.18602760	0.17886915
CB1	0.00529081	0.00577781	0.00503492	0.00628291	0.00669499	0.00676373	0.00799108	0.00768358
CB2	0.00731916	0.00799287	0.00696517	0.00869161	0.00926166	0.00935676	0.01105464	0.01062925
CB3	0.00874586	0.00955089	0.00832287	0.01038583	0.01106701	0.01118064	0.01320948	0.01270118
CB4	0.00790649	0.00863426	0.00752410	0.00938907	0.01000487	0.01010759	0.01194172	0.01148220
BI1	0.05982723	0.06533415	0.05693373	0.07104572	0.10283402	0.10388987	0.12274181	0.11801864
BI2	0.06270380	0.06847550	0.05967118	0.07446169	0.10777841	0.10888502	0.12864340	0.12369312
BI3	0.05928084	0.06473746	0.05641376	0.07039687	0.10189485	0.10294105	0.12162083	0.11694079
BI4	0.05645053	0.06164663	0.05372034	0.06703583	0.09702998	0.09802623	0.11581415	0.11135756
LA1	0.05316383	0.05805740	0.05059260	0.06313283	0.08427372	0.08513900	0.10058840	0.09671770
LA2	0.04675751	0.05106140	0.04449612	0.05552523	0.07411862	0.07487963	0.08846736	0.08506308
LA3	0.04791406	0.05232441	0.04559673	0.05689865	0.07595195	0.07673178	0.09065560	0.08716712
LA4	0.05490588	0.05995980	0.05225039	0.06520154	0.08703517	0.08792880	0.10388444	0.09988690
PRB1	0.08501993	0.09284576	0.08090800	0.10096241	0.05828611	0.05888456	0.06956980	0.06689272
PRB2	0.07319603	0.07993350	0.06965596	0.08692136	0.05018014	0.05069536	0.05989459	0.05758981
PRB3	0.08191837	0.08945871	0.07795645	0.09727927	0.05615981	0.05673643	0.06703187	0.06445245
PRB4	0.07489022	0.08178364	0.07126821	0.08893323	0.05134160	0.05186875	0.06128090	0.05892278
B1	0.03136750	0.03425479	0.02985043	0.03724937	0.05220277	0.05273876	0.06230878	0.05991110
B2	0.03082073	0.03365768	0.02933011	0.03660007	0.05129281	0.05181946	0.06122266	0.05886678
B3	0.02758706	0.03012637	0.02625283	0.03276004	0.04591124	0.04638264	0.05479927	0.05269056
B4	0.02920033	0.03188814	0.02778808	0.03467583	0.04859610	0.04909506	0.05800389	0.05577187

Appendix F: Research Data-Covariance Matrix from lavaan

Column 1	cov.PBC1	cov.PBC2	cov.PBC3	cov.PBC4	cov.BB1	cov.BB2	cov.BB3	cov.BB4
ATB1	0.00024477	0.00026009	0.00021685	0.00021306	0.05740308	0.08132933	0.07440822	0.06073466
ATB2	0.00026730	0.00028403	0.00023681	0.00023267	0.06268686	0.08881545	0.08125727	0.06632510
ATB3	0.00023293	0.00024751	0.00020636	0.00020276	0.05462682	0.07739589	0.07080952	0.05779727
ATB4	0.00029067	0.00030886	0.00025751	0.00025301	0.06816700	0.09657977	0.08836086	0.07212330
SN1	0.00030974	0.00032912	0.00027440	0.00026961	0.02174359	0.03080656	0.02818493	0.02300555
SN2	0.00031292	0.00033250	0.00027722	0.00027237	0.02196684	0.03112287	0.02847432	0.02324176
SN3	0.00036970	0.00039283	0.00032752	0.00032180	0.02595297	0.03677045	0.03364130	0.02745923
SN4	0.00035547	0.00037772	0.00031492	0.00030942	0.02495428	0.03535550	0.03234676	0.02640259
PBC1	1.00706688	0.70481007	0.58762386	0.57736101	0.00002105	0.00002983	0.00002729	0.00002228
PBC2	0.70481007	0.89132335	0.62439860	0.61349348	0.00002237	0.00003170	0.00002900	0.00002367
PBC3	0.58762386	0.62439860	0.92305568	0.51149015	0.00001865	0.00002643	0.00002418	0.00001973
PBC4	0.57736101	0.61349348	0.51149015	0.90083348	0.00001833	0.00002596	0.00002375	0.00001939
BB1	0.00002105	0.00002237	0.00001865	0.00001833	0.53976569	0.25655427	0.23472156	0.19158816
BB2	0.00002983	0.00003170	0.00002643	0.00002596	0.25655427	0.53976901	0.33255613	0.27144425
BB3	0.00002729	0.00002900	0.00002418	0.00002375	0.23472156	0.33255613	0.57932197	0.24834440
BB4	0.00002228	0.00002367	0.00001973	0.00001939	0.19158816	0.27144425	0.24834440	0.56222202
NB1	0.00092246	0.00098019	0.00081722	0.00080294	0.06475699	0.09174842	0.08394065	0.06851537
NB2	0.00098769	0.00104950	0.00087501	0.00085972	0.06933635	0.09823652	0.08987662	0.07336052
NB3	0.00104679	0.00111231	0.00092737	0.00091117	0.07348549	0.10411507	0.09525490	0.07775047
NB4	0.00100063	0.00106325	0.00088647	0.00087099	0.07024477	0.09952357	0.09105414	0.07432166
CB1	0.01739141	0.01847980	0.01540723	0.01513814	0.00045507	0.00064475	0.00058988	0.00048148
CB2	0.02405880	0.02556445	0.02131394	0.02094169	0.00062953	0.00089193	0.00081603	0.00066607
CB3	0.02874850	0.03054764	0.02546860	0.02502379	0.00075224	0.00106579	0.00097509	0.00079590
CB4	0.02598940	0.02761588	0.02302429	0.02262217	0.00068005	0.00096350	0.00088151	0.00071952
BI1	0.17050517	0.18117574	0.15105231	0.14841418	0.04011383	0.05683373	0.05199719	0.04244197
BI2	0.17870327	0.18988690	0.15831510	0.15555012	0.04204256	0.05956636	0.05449728	0.04448263
BI3	0.16894797	0.17952109	0.14967277	0.14705873	0.03974748	0.05631467	0.05152230	0.04205435
BI4	0.16088170	0.17095002	0.14252678	0.14003755	0.03784977	0.05362598	0.04906242	0.04004651
LA1	-0.00092942	-0.00098758	-0.00082338	-0.00080900	0.04658606	0.06600365	0.06038676	0.04928984
LA2	-0.00081742	-0.00086858	-0.00072416	-0.00071152	0.04097238	0.05805012	0.05311007	0.04335034
LA3	-0.00083764	-0.00089006	-0.00074207	-0.00072911	0.04198583	0.05948599	0.05442375	0.04442262
LA4	-0.00095987	-0.00101994	-0.00085036	-0.00083551	0.04811257	0.06816643	0.06236548	0.05090495
PRB1	0.00156832	0.00166646	0.00138939	0.00136512	0.06012552	0.08518651	0.07793716	0.06361511
PRB2	0.00135021	0.00143471	0.00119616	0.00117527	0.05176374	0.07333945	0.06709828	0.05476802
PRB3	0.00151110	0.00160567	0.00133870	0.00131532	0.05793212	0.08207888	0.07509398	0.06129440
PRB4	0.00138146	0.00146791	0.00122385	0.00120247	0.05296186	0.07503696	0.06865133	0.05603568
B1	0.12442636	0.13221322	0.11023061	0.10830543	0.02397876	0.03397337	0.03108224	0.02537044
B2	0.12225746	0.12990858	0.10830916	0.10641754	0.02356078	0.03338117	0.03054044	0.02492820
B3	0.10943038	0.11627876	0.09694552	0.09525236	0.02108881	0.02987887	0.02733618	0.02231277
B4	0.11582979	0.12307867	0.10261482	0.10082265	0.02232207	0.03162616	0.02893478	0.02361761

Column 1	cov.NB1	cov.NB2	cov.NB3	cov.NB4	cov.CB1	cov.CB2	cov.CB3	cov.CB4
ATB1	0.05076359	0.05435340	0.05760595	0.05506551	0.00529081	0.00731916	0.00874586	0.00790649
ATB2	0.05543623	0.05935647	0.06290840	0.06013413	0.00577781	0.00799287	0.00955089	0.00863426
ATB3	0.04830845	0.05172464	0.05481988	0.05240231	0.00503492	0.00696517	0.00832287	0.00752410
ATB4	0.06028251	0.06454546	0.06840791	0.06539111	0.00628291	0.00869161	0.01038583	0.00938907
SN1	0.14367934	0.15383979	0.16304568	0.15585533	0.00669499	0.00926166	0.01106701	0.01000487
SN2	0.14515456	0.15541934	0.16471974	0.15745557	0.00676373	0.00935676	0.01118064	0.01010759
SN3	0.17149443	0.18362187	0.19460994	0.18602760	0.00799108	0.01105464	0.01320948	0.01194172
SN4	0.16489523	0.17655599	0.18712123	0.17886915	0.00768358	0.01062925	0.01270118	0.01148220
PBC1	0.00092246	0.00098769	0.00104679	0.00100063	0.01739141	0.02405880	0.02874850	0.02598940
PBC2	0.00098019	0.00104950	0.00111231	0.00106325	0.01847980	0.02556445	0.03054764	0.02761588
PBC3	0.00081722	0.00087501	0.00092737	0.00088647	0.01540723	0.02131394	0.02546860	0.02302429
PBC4	0.00080294	0.00085972	0.00091117	0.00087099	0.01513814	0.02094169	0.02502379	0.02262217
BB1	0.06475699	0.06933635	0.07348549	0.07024477	0.00045507	0.00062953	0.00075224	0.00068005
BB2	0.09174842	0.09823652	0.10411507	0.09952357	0.00064475	0.00089193	0.00106579	0.00096350
BB3	0.08394065	0.08987662	0.09525490	0.09105414	0.00058988	0.00081603	0.00097509	0.00088151
BB4	0.06851537	0.07336052	0.07775047	0.07432166	0.00048148	0.00066607	0.00079590	0.00071952
NB1	0.68083321	0.45816724	0.48558431	0.46416994	0.01993908	0.02758318	0.03295987	0.02979660
NB2	0.45816724	0.68678924	0.51992299	0.49699428	0.02134910	0.02953376	0.03529067	0.03190370
NB3	0.48558431	0.51992299	0.81666542	0.52673478	0.02262664	0.03130108	0.03740249	0.03381284
NB4	0.46416994	0.49699428	0.52673478	0.70198786	0.02162880	0.02992069	0.03575303	0.03232169
CB1	0.01993908	0.02134910	0.02262664	0.02162880	1.12083369	0.52003497	0.62140357	0.56176528
CB2	0.02758318	0.02953376	0.03130108	0.02992069	0.52003497	1.15306685	0.85963267	0.77713070
CB3	0.03295987	0.03529067	0.03740249	0.03575303	0.62140357	0.85963267	1.34995602	0.92861408
CB4	0.02979660	0.03190370	0.03381284	0.03232169	0.56176528	0.77713070	0.92861408	1.16323356
BI1	0.14994325	0.16054667	0.17015390	0.16265008	0.01013126	0.01401531	0.01674726	0.01513997
BI2	0.15715271	0.16826595	0.17833511	0.17047050	0.01061838	0.01468918	0.01755249	0.01586792
BI3	0.14857384	0.15908041	0.16859990	0.16116461	0.01003873	0.01388731	0.01659431	0.01500170
BI4	0.14148031	0.15148526	0.16055025	0.15346996	0.00955944	0.01322427	0.01580203	0.01428545
LA1	0.25098486	0.26873356	0.28481477	0.27225439	-0.02008953	-0.02779130	-0.03320856	-0.03002142
LA2	0.22074083	0.23635079	0.25049419	0.23944735	-0.01766871	-0.02444241	-0.02920688	-0.02640379
LA3	0.22620086	0.24219693	0.25669017	0.24537008	-0.01810574	-0.02504699	-0.02992931	-0.02705689
LA4	0.25920902	0.27753930	0.29414746	0.28117550	-0.02074781	-0.02870195	-0.03429672	-0.03100515
PRB1	0.17358828	0.18586379	0.19698601	0.18829889	0.03389940	0.04689551	0.05603668	0.05065865
PRB2	0.14944700	0.16001532	0.16959076	0.16211177	0.02918494	0.04037365	0.04824354	0.04361344
PRB3	0.16725572	0.17908341	0.18979989	0.18142968	0.03266274	0.04518474	0.05399244	0.04881060
PRB4	0.15290608	0.16371902	0.17351609	0.16586400	0.02986045	0.04130813	0.04936019	0.04462291
B1	0.11073545	0.11856624	0.12566134	0.12011965	-0.00065634	-0.00090796	-0.00108494	-0.00098082
B2	0.10880520	0.11649949	0.12347091	0.11802582	-0.00064490	-0.00089213	-0.00106603	-0.00096372
B3	0.09738952	0.10427653	0.11051652	0.10564272	-0.00057723	-0.00079853	-0.00095419	-0.00086261
B4	0.10308479	0.11037455	0.11697945	0.11182063	-0.00061099	-0.00084523	-0.00100999	-0.00091305

Column 1	cov.BI1	cov.BI2	cov.BI3	cov.BI4	cov.LA1	cov.LA2	cov.LA3	cov.LA4
ATB1	0.05982723	0.06270380	0.05928084	0.05645053	0.05316383	0.04675751	0.04791406	0.05490588
ATB2	0.06533415	0.06847550	0.06473746	0.06164663	0.05805740	0.05106140	0.05232441	0.05995980
ATB3	0.05693373	0.05967118	0.05641376	0.05372034	0.05059260	0.04449612	0.04559673	0.05225039
ATB4	0.07104572	0.07446169	0.07039687	0.06703583	0.06313283	0.05552523	0.05689865	0.06520154
SN1	0.10283402	0.10777841	0.10189485	0.09702998	0.08427372	0.07411862	0.07595195	0.08703517
SN2	0.10388987	0.10888502	0.10294105	0.09802623	0.08513900	0.07487963	0.07673178	0.08792880
SN3	0.12274181	0.12864340	0.12162083	0.11581415	0.10058840	0.08846736	0.09065560	0.10388444
SN4	0.11801864	0.12369312	0.11694079	0.11135756	0.09671770	0.08506308	0.08716712	0.09988690
PBC1	0.17050517	0.17870327	0.16894797	0.16088170	-0.00092942	-0.00081742	-0.00083764	-0.00095987
PBC2	0.18117574	0.18988690	0.17952109	0.17095002	-0.00098758	-0.00086858	-0.00089006	-0.00101994
PBC3	0.15105231	0.15831510	0.14967277	0.14252678	-0.00082338	-0.00072416	-0.00074207	-0.00085036
PBC4	0.14841418	0.15555012	0.14705873	0.14003755	-0.00080900	-0.00071152	-0.00072911	-0.00083551
BB1	0.04011383	0.04204256	0.03974748	0.03784977	0.04658606	0.04097238	0.04198583	0.04811257
BB2	0.05683373	0.05956636	0.05631467	0.05362598	0.06600365	0.05805012	0.05948599	0.06816643
BB3	0.05199719	0.05449728	0.05152230	0.04906242	0.06038676	0.05311007	0.05442375	0.06236548
BB4	0.04244197	0.04448263	0.04205435	0.04004651	0.04928984	0.04335034	0.04442262	0.05090495
NB1	0.14994325	0.15715271	0.14857384	0.14148031	0.25098486	0.22074083	0.22620086	0.25920902
NB2	0.16054667	0.16826595	0.15908041	0.15148526	0.26873356	0.23635079	0.24219693	0.27753930
NB3	0.17015390	0.17833511	0.16859990	0.16055025	0.28481477	0.25049419	0.25669017	0.29414746
NB4	0.16265008	0.17047050	0.16116461	0.15346996	0.27225439	0.23944735	0.24537008	0.28117550
CB1	0.01013126	0.01061838	0.01003873	0.00955944	-0.02008953	-0.01766871	-0.01810574	-0.02074781
CB2	0.01401531	0.01468918	0.01388731	0.01322427	-0.02779130	-0.02444241	-0.02504699	-0.02870195
CB3	0.01674726	0.01755249	0.01659431	0.01580203	-0.03320856	-0.02920688	-0.02992931	-0.03429672
CB4	0.01513997	0.01586792	0.01500170	0.01428545	-0.03002142	-0.02640379	-0.02705689	-0.03100515
BI1	0.77429768	0.60939875	0.57613204	0.54862514	0.27758440	0.24413509	0.25017378	0.28668016
BI2	0.60939875	0.83081765	0.60383320	0.57500373	0.29093101	0.25587341	0.26220245	0.30046411
BI3	0.57613204	0.60383320	0.86329244	0.54361462	0.27504926	0.24190544	0.24788897	0.28406195
BI4	0.54862514	0.57500373	0.54361462	0.97389959	0.26191729	0.23035588	0.23605374	0.27049967
LA1	0.27758440	0.29093101	0.27504926	0.26191729	1.12395424	0.69527269	0.71247027	0.81643686
LA2	0.24413509	0.25587341	0.24190544	0.23035588	0.69527269	0.90715655	0.62661659	0.71805507
LA3	0.25017378	0.26220245	0.24788897	0.23605374	0.71247027	0.62661659	0.84998720	0.73581617
LA4	0.28668016	0.30046411	0.28406195	0.27049967	0.81643686	0.71805507	0.73581617	1.21448766
PRB1	0.17064485	0.17884967	0.16908637	0.16101350	0.14568716	0.12813165	0.13130099	0.15046097
PRB2	0.14691291	0.15397667	0.14557118	0.13862101	0.12542614	0.11031211	0.11304069	0.12953605
PRB3	0.16441966	0.17232517	0.16291804	0.15513967	0.14037244	0.12345736	0.12651108	0.14497210
PRB4	0.15031335	0.15754060	0.14894056	0.14182952	0.12832924	0.11286539	0.11565712	0.13253428
B1	0.26085708	0.27339942	0.25847471	0.24613407	0.29367841	0.25828975	0.26467855	0.30330153
B2	0.25631003	0.26863374	0.25396919	0.24184366	0.28855924	0.25378745	0.26006488	0.29801462
B3	0.22941835	0.24044907	0.22732310	0.21646977	0.25828402	0.22716044	0.23277925	0.26674736
B4	0.24283458	0.25451037	0.24061680	0.22912877	0.27338830	0.24044462	0.24639202	0.28234656

Column 1	cov.PRB1	cov.PRB2	cov.PRB3	cov.PRB4	cov.B1	cov.B2	cov.B3	cov.B4
ATB1	0.08501993	0.07319603	0.08191837	0.07489022	0.03136750	0.03082073	0.02758706	0.02920033
ATB2	0.09284576	0.07993350	0.08945871	0.08178364	0.03425479	0.03365768	0.03012637	0.03188814
ATB3	0.08090800	0.06965596	0.07795645	0.07126821	0.02985043	0.02933011	0.02625283	0.02778808
ATB4	0.10096241	0.08692136	0.09727927	0.08893323	0.03724937	0.03660007	0.03276004	0.03467583
SN1	0.05828611	0.05018014	0.05615981	0.05134160	0.05220277	0.05129281	0.04591124	0.04859610
SN2	0.05888456	0.05069536	0.05673643	0.05186875	0.05273876	0.05181946	0.04638264	0.04909506
SN3	0.06956980	0.05989459	0.06703187	0.06128090	0.06230878	0.06122266	0.05479927	0.05800389
SN4	0.06689272	0.05758981	0.06445245	0.05892278	0.05991110	0.05886678	0.05269056	0.05577187
PBC1	0.00156832	0.00135021	0.00151110	0.00138146	0.12442636	0.12225746	0.10943038	0.11582979
PBC2	0.00166646	0.00143471	0.00160567	0.00146791	0.13221322	0.12990858	0.11627876	0.12307867
PBC3	0.00138939	0.00119616	0.00133870	0.00122385	0.11023061	0.10830916	0.09694552	0.10261482
PBC4	0.00136512	0.00117527	0.00131532	0.00120247	0.10830543	0.10641754	0.09525236	0.10082265
BB1	0.06012552	0.05176374	0.05793212	0.05296186	0.02397876	0.02356078	0.02108881	0.02232207
BB2	0.08518651	0.07333945	0.08207888	0.07503696	0.03397337	0.03338117	0.02987887	0.03162616
BB3	0.07793716	0.06709828	0.07509398	0.06865133	0.03108224	0.03054044	0.02733618	0.02893478
BB4	0.06361511	0.05476802	0.06129440	0.05603568	0.02537044	0.02492820	0.02231277	0.02361761
NB1	0.17358828	0.14944700	0.16725572	0.15290608	0.11073545	0.10880520	0.09738952	0.10308479
NB2	0.18586379	0.16001532	0.17908341	0.16371902	0.11856624	0.11649949	0.10427653	0.11037455
NB3	0.19698601	0.16959076	0.18979989	0.17351609	0.12566134	0.12347091	0.11051652	0.11697945
NB4	0.18829889	0.16211177	0.18142968	0.16586400	0.12011965	0.11802582	0.10564272	0.11182063
CB1	0.03389940	0.02918494	0.03266274	0.02986045	-0.00065634	-0.00064490	-0.00057723	-0.00061099
CB2	0.04689551	0.04037365	0.04518474	0.04130813	-0.00090796	-0.00089213	-0.00079853	-0.00084523
CB3	0.05603668	0.04824354	0.05399244	0.04936019	-0.00108494	-0.00106603	-0.00095419	-0.00100999
CB4	0.05065865	0.04361344	0.04881060	0.04462291	-0.00098082	-0.00096372	-0.00086261	-0.00091305
BI1	0.17064485	0.14691291	0.16441966	0.15031335	0.26085708	0.25631003	0.22941835	0.24283458
BI2	0.17884967	0.15397667	0.17232517	0.15754060	0.27339942	0.26863374	0.24044907	0.25451037
BI3	0.16908637	0.14557118	0.16291804	0.14894056	0.25847471	0.25396919	0.22732310	0.24061680
BI4	0.16101350	0.13862101	0.15513967	0.14182952	0.24613407	0.24184366	0.21646977	0.22912877
LA1	0.14568716	0.12542614	0.14037244	0.12832924	0.29367841	0.28855924	0.25828402	0.27338830
LA2	0.12813165	0.11031211	0.12345736	0.11286539	0.25828975	0.25378745	0.22716044	0.24044462
LA3	0.13130099	0.11304069	0.12651108	0.11565712	0.26467855	0.26006488	0.23277925	0.24639202
LA4	0.15046097	0.12953605	0.14497210	0.13253428	0.30330153	0.29801462	0.26674736	0.28234656
PRB1	0.58528868	0.34573416	0.38693326	0.35373649	0.08753607	0.08601021	0.07698614	0.08148824
PRB2	0.34573416	0.44972120	0.33312165	0.30454162	0.07536224	0.07404859	0.06627952	0.07015550
PRB3	0.38693326	0.33312165	0.54182324	0.34083205	0.08434272	0.08287252	0.07417766	0.07851551
PRB4	0.35373649	0.30454162	0.34083205	0.50893293	0.07710657	0.07576251	0.06781362	0.07177931
B1	0.08753607	0.07536224	0.08434272	0.07710657	1.31456123	1.03803771	0.92912829	0.98346308
B2	0.08601021	0.07404859	0.08287252	0.07576251	1.03803771	1.22808323	0.91293247	0.96632013
B3	0.07698614	0.06627952	0.07417766	0.06781362	0.92912829	0.91293247	1.05711739	0.86493522
B4	0.08148824	0.07015550	0.07851551	0.07177931	0.98346308	0.96632013	0.86493522	1.22922102

Appendix G: Language Editing Certificate

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EDITING CERTIFICATE

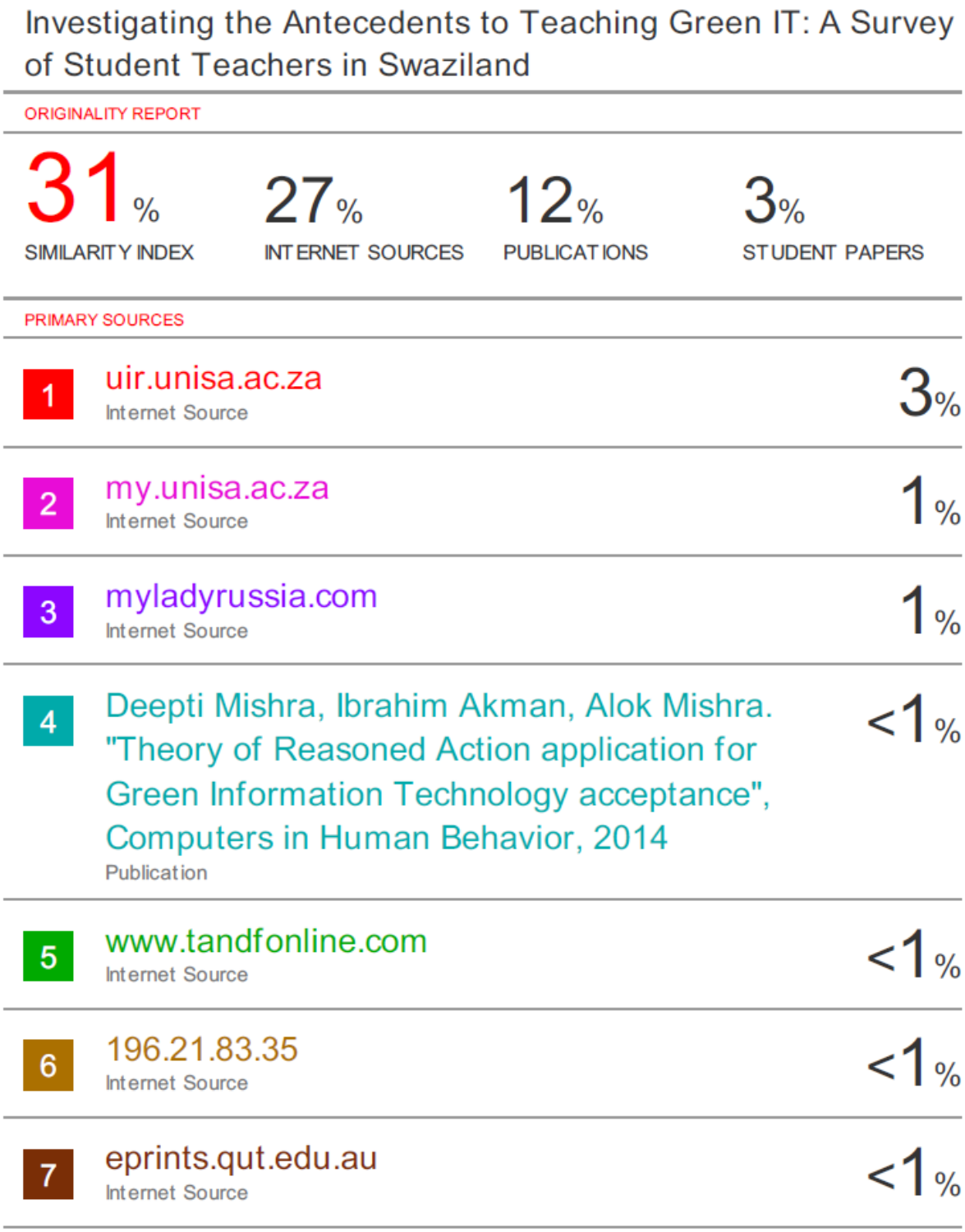
To: **RICKY NHLANHLA DLAMINI (43572774)**
For editing Master's dissertation: **INVESTIGATING THE ANTECEDENTS TO TEACHING GREEN INFORMATION TECHNOLOGY (GREEN IT): A SURVEY OF STUDENT TEACHERS IN SWAZILAND**

I confirm that I have edited this dissertation and the references for clarity, language and layout. I am a freelance editor specialising in proofreading and editing academic documents. I returned the document to the author with track changes so correct implementation of the changes in the text and references is the responsibility of the author. My original tertiary degree which I obtained at the University of Cape Town was a B.A. with English as a major and I went on to complete an H.D.E. (P.G.) Sec. with English as my teaching subject. I obtained a distinction for my M.Tech. dissertation in the Department of Homeopathy at Technikon Natal in 1999 (now the Durban University of Technology). During my 13 years as a part-time lecturer in the Department of Homoeopathy at the Durban University of Technology I supervised numerous Master's degree dissertations.

Dr Richard Steele
29 August 2018
per email

Appendix H: Turnitin Originality Report

Once all the chapters of the dissertation were completed, the dissertation was submitted to Turnitin, which is originality checking software that looks for exact or very similar matches of words and phrases in the dissertation to those in published Internet and academic sources. The intent is to prevent plagiarism. At first, the entire dissertation was submitted to Turnitin, including the appendices, and no filters within Turnitin were applied, such as the exclude bibliography filter. The result was a 31% similarity index as shown in the Figure H.1 below:



Investigating the Antecedents to Teaching Green IT: A Survey of Student Teachers in Swaziland

ORIGINALITY REPORT

31%	27%	12%	3%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	uir.unisa.ac.za Internet Source	3%
2	my.unisa.ac.za Internet Source	1%
3	myladyrussia.com Internet Source	1%
4	Deepti Mishra, Ibrahim Akman, Alok Mishra. "Theory of Reasoned Action application for Green Information Technology acceptance", Computers in Human Behavior, 2014 Publication	<1%
5	www.tandfonline.com Internet Source	<1%
6	196.21.83.35 Internet Source	<1%
7	eprints.qut.edu.au Internet Source	<1%

Figure H.1: Initial Turnitin similarity index

However, on inspection of the words and phrases highlighted on each page by Turnitin, it was evident that a large volume of the similarities were due to:

- The references. Since the dissertation used APA referencing as have many other publications that referenced the same articles, this was expected. Importantly, Turnitin showed that each similar reference was similar to a different primary source than the other similar references. No large chucks of references were similar to single sources.
- The appendices. This appeared to be mostly due to the participant information sheet and cover letter to the online anonymous web-based survey, because these have the standardised wording required by the Unisa School of Computing for all its students, so, it is expected to be similar many past students due to school policy.
- The standard construct terms, labels, headings and phrases. Turnitin highlighted the frequently used standard construct terms used for this study. The study used the standard construct terms in use since it proceeded to verify aspects of established theories to address the study's particular research problem.

Based on the above, it was deemed necessary to submit the dissertation again to Turnitin with the following changes:

- The Turnitin references filter activated to exclude the bibliography,
- All the appendices removed,
- The Turnitin quotes filter activated to exclude direct quotes. Although, the only direct quotes were in Section 1.2, glossary of key terms, and had correct in-text citations with page numbers,
- The Turnitin word filter activated to exclude matches that are less than 5 words, so, four words or less. This is recommended by Turnitin at https://guides.turnitin.com/01_Manuals_and_Guides/Student_Guides/Feedback_Studio/15_The_Similarity_Report/Interpreting_the_Similarity_Report (Retrieved on 15 Aug 2018).

The result was a much reduced 23% similarity index as shown in the Figure H.2 below:

INVESTIGATING THE ANTECEDENTS TO TEACHING GREEN INFORMATION TECHNOLOGY (GREEN IT): A SURVEY OF STUDENT TEACHERS IN SWAZILAND

ORIGINALITY REPORT

23%	19%	8%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of South Africa Student Paper	1%
2	uir.unisa.ac.za Internet Source	1%
3	bura.brunel.ac.uk Internet Source	1%
4	Submitted to Birla Institute of Technology Student Paper	1%
5	Deepti Mishra, Ibrahim Akman, Alok Mishra. "Theory of Reasoned Action application for Green Information Technology acceptance", Computers in Human Behavior, 2014 Publication	1%
6	epubs.scu.edu.au Internet Source	<1%
7	www.tandfonline.com Internet Source	<1%

Figure H.2: Filtered Turnitin similarity index

However, on inspection again of the words and phrases highlighted on each page by Turnitin, it was still evident that a large volume of the similarities were due to standard construct terms, labels, headings and phrases. Importantly, all the words and phrases highlighted by the Turnitin software were correctly referenced in the dissertation, their sources acknowledged

and used in acceptably paraphrased arguments. Thus, no plagiarism was evident in the dissertation.

Both of the above full Turnitin reports are available in electronic format for inspection by the reader by request, since each is longer than the entire dissertation itself and between 48 and 62 megabytes in size. If required, please request these via the Unisa School of Computing's examinations contact person and provide a suitable repository for us to upload it to, such as Dropbox or Google Drive (since the files are too big for e-mail).