NAMIBIA UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEVELOPING PERSUASIVE STRATEGIES TO FACILITATE THE USE OF MOBILE HEALTH APPLICATIONS FOR STRESS MANAGEMENT AMONG NUST STUDENTS

By

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DECLARATION

I, Benjamin Akintunde Akinmoyeje, hereby declare that the work contained in the thesis for the Masters programme, entitled: "DEVELOPING PERSUASIVE STRATEGIES TO FACILITATE THE USE OF MOBILE HEALTH APPLICATIONS FOR STRESS MANAGEMENT AMONG UNIVERSITY STUDENTS: A CASE STUDY OF NAMIBIA UNIVERSITY" is my own original work and that I have not previously in its entirety or in part submitted it at any university or other higher education institution for the award of a degree.

I further declare that I will fully acknowledge any sources of information I will use for the research in accordance with the Institution rules.

Signature: _____ Date: ___30/07/2020_____

SIGNATURE OF THE SUPERVISOR

I, _____, herewith declare that I accept this proposal for my supervision

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ABSTRACT

ABSTRACT

Unmanaged stress negatively impacts the health of students and it has a tendency of leading to mental health disorders. Hence, the alarming statistics on stress - induced conditions in Namibia calls for concern. Unmanaged stress can potentially lead to depression. Unsurprisingly, depression is one of the major contributors to suicide in Namibia. Namibia ranks the 4th highest country in Africa on suicide rates within the age group of 18-28 years. This represents a significant percentage of the vulnerable population susceptible to suicide in the country. Mobile health (mHealth) applications have achieved remarkable success in the healthcare domain. The use of mHealth applications to manage chronic illnesses has gained popularity with patients especially as mobile phones become ubiquitous. Mobile apps for stress management are readily available and can be easily downloaded online for individual use. Most of these mHealth applications are free and they work either online or offline. However there is limited use of mHealth applications for stress management among Namibian students despite the availability of mHealth applications for stress management that can help improve the handling of stress conditions. Persuasive technology is the use of computers to change people's behaviour. Persuasive technologies have the potential of improving health behaviour as shown in the literature. Unfortunately, there is limited study to show persuasive strategies included in some of the available mHealth applications for stress management, especially for the Namibian context. There is a need to investigate persuasive strategies that will motivate NUST students to use mHealth applications to initiate health behavioural change. This study planned to develop persuasive strategies that would facilitate the use of mHealth applications for stress management among NUST students. This was done by identifying persuasive elements in existing academic literature and qualitative research methodology was used to investigate suitable persuasive strategies required to motivate the use of mHealth apps for stress management among NUST students. Design Science Research strategy was applied in the study and NUST was the case considered in the evaluation of the developed guidelines. The first phase of the research was systematic literature scoping to identify elements of persuasive strategies in existing literature and persuasive elements in mobile apps for stress management. The review identified 21 persuasive strategies in the thirty-one (31) studies evaluated. The second phase included student interviews, which were developed with selected lists of context relevant elements of persuasive strategies to see which of them applied to NUST students. The outcome of the interviews was a list of elements of persuasive strategies found to facilitate the use of mHealth apps for stress management by the students and draft guidelines developed. Content analysis was used to analyse the data gathered from the interviews. The final phase involved interviews with mental health professionals and mHealth apps developers to review and validate the identified elements of persuasive strategies and guidelines identified; for their efficacy and suitability for mHealth apps for stress management among NUST students. The findings revealed 24 persuasive elements. Personalization, Tunnelling, Mindfulness, Self-tracking, Social Influence and Reminders were among the preferred persuasive strategies for mHealth apps for stress management. Scarcity, Liking, Leaderboard and Environment were not favoured. Engaging elements of persuasive strategies of the end users can improve the use of mHealth apps for stress management. It is anticipated that the findings of this study will be incorporated into existing and future mHealth apps for stress management especially for students by developers.

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CHAPTER ONE

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The purpose of this study was to develop persuasive strategies that will facilitate the use of mHealth applications to support stress management among university students at the Namibian University of Science and Technology (NUST). This was done by identifying persuasive elements in existing academic literature. Qualitative research methodology was used to investigate suitable persuasive strategies required for mHealth apps for stress management among the students.

There is a healthy level of stress that can be productive (Sharma & Rush, 2014). However, chronic stress is common around the world, affecting millions of people with considerable social impact and substantial economic cost (Carissoli et. al.,2015).

In educational settings, there is a high rate of stress-induced conditions among students. These include chronic stress, headaches, depression, poor academic performance, alcohol abuse and lack of sleep (Ramli, Alavi, Mehrinezhad, & Ahmadi, 2018).

Stress and anxiety among university students are common occurrences. This is because of concerns such as academic pressure, financial burden, family pressure, relationship challenges, and other mental health related issues (Hargreaves, Rustage, Nellums, McAlpine, Pocock & Devakumar, 2019).

Poorly managed stress conditions can lead to dire conditions in students' mental health, especially in universities where expectations are high. The consequences include depression, burnout, school dropout because of poor grades, loss of appetite and gender-based violence (Sharma & Rush, 2014) among others. Though stress cannot be prevented, it can be managed (Carissoli, Villani, & Riva, 2015).

Mobile health (mHealth) applications have achieved remarkable success in the healthcare domain (Iyawa & Hamunyela, 2019). The use of mHealth applications to manage chronic illnesses have gained popularity with patients, especially as mobile phones become ubiquitous (WHO & ITU, 2017). Mobile apps for stress management are readily available and can be easily downloaded online for individual use (Simões, Sílva, & Gonçalves, 2018). Most of these mHealth applications are free and they work either online or offline. Some of the mobile apps available for stress management include Breathe2Relax

(Psyberguide.org/apps/breathe2relax), Sanvello (www.sanvello.com), Calm (www.calm.com), De.Stressify (www.destressify.com), Heartmath (www.heartmath.com) and SAM-Self Help for Anxiety (sam-app.org.uk). These are free self-help apps for managing stressful conditions and they were designed by researchers at the University of West England – UWE (Matthews, Topham,& Caleb-Solly et al., 2018). They have been widely used in over one hundred (100) countries. The initial evaluations of these apps show limited persuasive strategies in their design, especially for health behavioural change (Geuens et al., 2016). One of the most used persuasive strategies in these mHealth applications is self-efficacy; where an individual monitors his or her stress condition and reports it.

Introducing persuasive technologies into mHealth apps can help achieve significant positive change of behaviour and adherence(Karppinen, Oinas-Kukkonen, Alahaivala, Jokelainen, Keranen, Salonurmi and Savolainen, 2016). People with health conditions like excessive cigarette smoking or unhealthy eating habits have benefitted from persuasive technology-based mHealth applications (Matthews et al., 2016).

Persuasive technology can be described as "any computing system, device, or application intentionally designed to change a person's attitudes or behaviour in a predetermined way" (Devincenzi, Kwecko, Pereira de Toledo, Mota, Casarin and da Costa Botelho, 2017). There is demonstrable proof that apps with this technology can improve physical exercise with those living with diabetes or who live sedentary lifestyles (Oduor & Oinas-Kukkonen, 2019). Persuasive technologies have also been used to motivate university students to embrace healthy social interactions (Devincenzi et al., 2017a).

There are different elements of persuasive strategies for mHealth presented in the literature which are considered in chapter 3. These elements are further explored among NUST students in chapter 4.

In this chapter, background of the study, the methodology, data analysis, the research questions and research objectives are discussed.

1.2 BACKGROUND
The background to the study is explored in subsequent sections.

1.2.1. BACKGROUND TO THE STUDY
Preliminary research indicated that majority of the students at the Namibia University of Science and Technology (NUST) were not aware of mHealth applications for their stress condition and management and did not use already existing apps. There was also limited literature on the use of mHealth applications for stress management among students in Namibia.

Universities in Namibia include NUST, the University of Namibia (UNAM) and the International University of Management (IUM); they are all situated in the Khomas region. The region ranks among the top four with the highest suicide rates in Namibia (Kangootui, 2016). According to Coyle & Vera (2013), urban centers tend to account for more stressful situations for university students.

The Ministry of Health and Social Services (MOHSS) National Study on the Prevalence of and Interventions in Relation to Suicides in Namibia, indicates ages 20-30 (coincidentally the age range of most of the university student population) as the range with the highest number of people with attempted suicides; especially among the educated living in urban settings such as the Khomas region(Akca, Yuncu & Aydin, 2018). The findings suggest that Namibia has the eleventh (11th) highest suicide rate in the world and the fourth (4th) highest in Africa (MOHSS, 2018). It was also reported that there is at least one suicide per day in Namibia and suicide was the second highest cause of death amongst youth between the ages of 15-29 years (Social Issues, 2018). According to the national statistics data (MOHSS, 2018), the university students' population is made up of the suicide susceptible age range.

1.2.2. PROBLEM STATEMENT

Between April and July 2018, one hundred and thirty-one (131) people committed suicide across the country (Ndanki, 2018). Namibia has the fourth (4th) highest suicide rate in Africa and is number eleven (11) in global ranking of countries' suicide rates (Kapitako, 2018).

Unfortunately, many students are not aware they are experiencing stress until they start experiencing stress symptoms. Some of the signs include mood swings, headaches, anxiety, worry, fatigue, rage, and lack of concentration.

Students have developed different self-help ways to cope with stress. They use coping mechanisms such as mindfulness (Ramli et al., 2018), self-regulation, meditation (Sharma & Rush, 2014),physical activities such as walking or running, while some, sleep.   Surprisingly, many of the students do not use mobile applications to manage their stress situations despite the availability of such apps, while a significant number are willing to use mobile apps to improve their stress situation.

The combination of the use of mHealth applications and any of the various coping mechanisms should yield positive results since it will aid progress tracking, personal intervention and will serve as a unique

experience for each student. It is also a cheaper and less stigmatizing alternative to other means of healthcare services (Dennison et al., 2013).

There are several studies on stress management using mobile technologies (Martín, De La Torre, Garcia-Zapirain, Lopez-Coronado, & Rodrigues, 2018; Price et al., 2014; Patrick et al., 2016; Carroll et al., 2013); Bunney, Zink, Holm, Billington, & Kotz, 2017). There are also persuasive strategies developed to support behavioural change among people using mHealth apps for health conditions as well as a lack of studies exploring what persuasive strategies can support stress management among university students, specifically in Namibia.

This study aimed at developing persuasive strategies that will facilitate the use of existing mHealth applications to support stress management among university students at NUST.

1.3. SIGNIFICANCE OF THE STUDY

- Unmanaged stress negatively impacts on the health of students and it has a tendency of leading to mental health disorders (Saxena et al., 2014). This study aimed to develop persuasive strategies that will facilitate the use of existing mHealth applications to support stress management among university students in Namibia.

- Stress is a growing problem that impacts a significant proportion of people (Carissoli et al., 2015). This study hopes to investigate persuasive strategies in existing mHealth applications for stress management that is suitable for Namibia University of Science and Technology students.

- The findings of this study should equip experts and those with already existing stress management apps to create or adjust their app designs to sufficiently address the stress situation of university students in Namibia. mHealth app designers and researchers in the area of user interface design and human computer interaction for stress management should find this work valuable.

- There are limited studies on developing countries' context about persuasive strategies for mHealth for stress management. There is also a limited theoretical framework to prove the efficacy of the strategies in developing countries. It will be significant to see more studies on sustainable persuasive strategies for long-time behavioural change after the agent of Persuasive

Technology (PT). The use of computer or digital technology to influence a user (Fogg, 2009) or Persuasive Strategies (PS) are the ways and means persuading the desired action from the user (Oyibo, Adaji, Orji, & Vassileva, 2018)(Adaji, Oyibo, & Vassileva, 2018). This should contribute to existing literature.

- In the long term, this study has the potential of helping to develop an artifact that can help reduce the high incidents of destructive outcomes of unmanaged stress conditions such as depression, poor academic performance, excessive eating and alcohol and risky sexual behavior. Ultimately it should contribute in positively impacting the statistics on depression, gender-based violence, suicides, road traffic accidents (alcohol induced) and generally improve university students' lifestyle, life expectancy and academic performance.

1.4. RESEARCH QUESTIONS

The main research question of this study is:

> ***How can persuasive strategies be developed to support stress management for university students at NUST?***

The main research question was supported by the following sub-research questions:

- What are the elements of persuasive strategies in mHealth applications to support stress in current literature?
- What are the elements of persuasive strategies to facilitate the use of mobile applications relevant to support stress management among university students in Namibia, as determined by NUST students?
- What guidelines or recommendations are required to be incorporated in the development of mHealth applications for stress management to facilitate use by university students in Namibia?
- What elements of persuasive strategies were found to be relevant to mHealth applications for stress management among university students in Namibia as determined by professionals in mHealth applications development practice?

1.5. RESEARCH OBJECTIVES

The main research objective of this study is:

> ***Develop persuasive strategies that will facilitate the use of mHealth applications to support stress management among university students at NUST***

In order to achieve the main objective of this study, the following sub-research objectives were addressed:

- To investigate the elements of persuasive strategies in mHealth applications for stress management in current literature.
- To investigate the elements of persuasive strategies to facilitate the use of mHealth applications relevant to support stress management among university students in Namibia, as determined by NUST students.
- To develop guidelines and recommendations capable of persuading students to use mHealth for stress management and instructional to developers and designers of mHealth app for stress management.
- To validate the elements of persuasive strategies in mHealth applications relevant to support stress management among university students in Namibia as determined by professionals in mHealth practice.

1.6. DELINEATION AND LIMITATIONS

This study was limited to developing and recommending guidelines for persuasive strategies for mHealth applications for stress management for university students in Namibia. The research did not include the development of mHealth applications.

Reports and documentation were limited to users' feedback on the mHealth applications. The research did not intend to directly investigate the mHealth applications.

This study report was within the duration of the Master's program and selection of students was limited to NUST because of administrative processes and time limitations.

1.7. RESEARCH METHODOLOGY

This study deployed a qualitative research methodology in collecting data and adopted the Onion Model (Saunders, Lewis, & Thornhill, 2019), which is made up of six (6) layers.

The research philosophy was interpretivism (discussed in Chapter 2), because it involved the use of qualitative research (case study, structured interviews, expert reviews, literature reviews) in the data collection and analysis (Burke et al., 2015). The approach used was inductive (Mathers, Fox, & Hunn, 2002). It entailed the creation of a theory on how to introduce persuasive strategies to facilitate the use of mHealth applications for stress management among NUST students. Design Science Research is suitable for behavioural science related studies because it is an appropriate way of involving information systems (Hevner, Brocke & Maedche, 2019). Unlike other strategies, it is holistic in approach (Saunders et al., 2019).

The process involved seven steps:

(1) The literature review that helped to identify the research problems.
(2) The problem statement and sub-objectives.
(3) The research questions about persuasive strategies.
(4) The research approach which was framed by Demonstration and suggested evaluation among NUST students.
(5) The research approach which suggested research activities (Evaluation).
(6) The research activities which generated Information System artifacts through qualitative methods. Findings were analyzed using content analysis and theme analysis.
(7) The communication of the result of the application of DSR. The study was cross-sectional.

Interviews were conducted and NUST was the case study. The data collection and analysis of interviews involved diverse segments of NUST students' population, there were discussions with students to evaluate the findings and developed guidelines were conducted. Qualitative open-ended questionnaires developed with the findings from the literature were administered and evaluated, content analysis was conducted to identify what were relevant persuasive strategies required for mHealth apps for stress management (Weller et al., 2018).

1.8. ETHICAL CONSIDERATIONS

This research was based on NUSTs' research ethic (NUST YearBook, 2020). The proposal was approved by the Department of Informatics and the Higher Degrees Committee (HDC). Ethical approval was sought from the Faculty Postgraduate Committee (Appendix 2). Permission was granted by the Registrar to gather data from students (Appendix 3).

A consent form was given to the participants stated the overall purpose of the study, any risks involved and any benefit to the participants.

The privacy and protection of the participants' data were taken into consideration, and data collected was only used for the purpose it was collected. The documents of the study would be kept by the researcher for a period of at least three years. The researcher guaranteed every participant's privacy and anonymity and no names and identities were disclosed. Interview responses were published anonymously. During the study, participants were informed of their right and freedom to either participate or opt-out of the study at any time during the interview. Hence the interview protocol included a voluntary and withdrawal statement.

1.9. THESIS STRUCTURE

- *Chapter One:* **Introduction:** This chapter discusses the persuasive nature of available mobile apps for stress management particularly among NUST students. The research questions, research objectives and scope of the study are presented.
- *Chapter Two*: **Research Methodology**: This chapter presents the methodology approach - the Research Onion and the Design Research Science methodology.
- *Chapter Three:* **Literature Review:** This chapter discusses published literature on mobile health, persuasive technologies and stress management.
- *Chapter Four:* **Findings From Students:** The findings and results of the student interviews which were both qualitative (thematic analysis) and quantitative (descriptive analysis) are presented in this chapter.

- *Chapter Five*: **Findings From Professionals:** This chapter discusses the findings and results of the interviews with professionals. The methods were qualitative and quantitative.

- *Chapter Six:* **Conclusions, Recommendations and Future Work:** This chapter concludes the work and summarizes the study. It states the achievement of the aims and objectives of the study. It also includes recommendations, acknowledgement of limitations of the study and future studies in this field of research.

1.10. SUMMARY OF THE CHAPTER

Chapter one covered the introduction and background of the study. It carefully highlighted the main research question and listed the sub research questions. An overview of the methodology and research design was presented. The thesis structure was described in this chapter.

CHAPTER TWO
RESEARCH METHODOLOGY

2.1. INTRODUCTION

This chapter outlines the methodology used for the research and the motivation for the research design. The research approach is discussed and the rationale of the data collection and analysis methods are explained. Furthermore, the processes of data collection and analysis are also detailed.

The purpose of this chapter is to present the process of the investigation. The research method is also known as the research strategy in some cases (M. Saunders et al., 2019). The design strategy adopted is the Design Science Research of evaluating research questions and creating required artifacts.

2.2. OVERVIEW OF THE CHAPTER

In this chapter, the methodology (Delphi Method), the philosophy, the mapping of the research questions with the research objectives and the research strategy are discussed in detail.

2.3. MAPPING THE RESEARCH QUESTIONS TO THE RESEARCH OBJECTIVES

Table 2.1: Mapping the Research Questions and Objectives to Chapters.

Main Research Question	Sub-research Questions	Research Objectives	Chapter
How can persuasive strategies be developed to support stress management for university students at NUST?	What are the elements of persuasive strategies in mHealth applications to support stress in the current literature?	To investigate the elements of persuasive strategies in mHealth applications for stress management in the current literature.	Chapter 3

	What are the elements of persuasive strategies to facilitate the use of mobile applications relevant to support stress management among university students in Namibia, as determined by NUST students?	To investigate the elements of persuasive strategies to facilitate the use of mHealth applications relevant to support stress management among university students in Namibia, as determined by NUST students.	Chapter 4
	What guidelines or recommendations are required to be incorporated in the development of mHealth applications for stress management to facilitate use by university students in Namibia?	To develop guidelines and recommendations capable of persuading students to use mHealth for stress management and instructional to developers and designers of mHealth app for stress management.	Chapter 4
	What elements of persuasive strategies were found to be relevant to mHealth applications for stress management among university students in Namibia as determined by professionals in mHealth applications development practice?	To validate the elements of persuasive strategies in mHealth applications relevant to support stress management among university students in Namibia as determined by professionals in mHealth practice.	Chapter 5

2.4. THE RESEARCH DESIGN

The Research Onion model methodology was adopted because it provides a template which describes the stages of research. Saunders et al., (2019) created a model that has found popularity among researchers. It describes the various components of the research methodology and design process. The researcher's overall view is that of Ontology – which means that what worked was the truth, as it was a context specific case study of university students' stress management reality in Namibia.
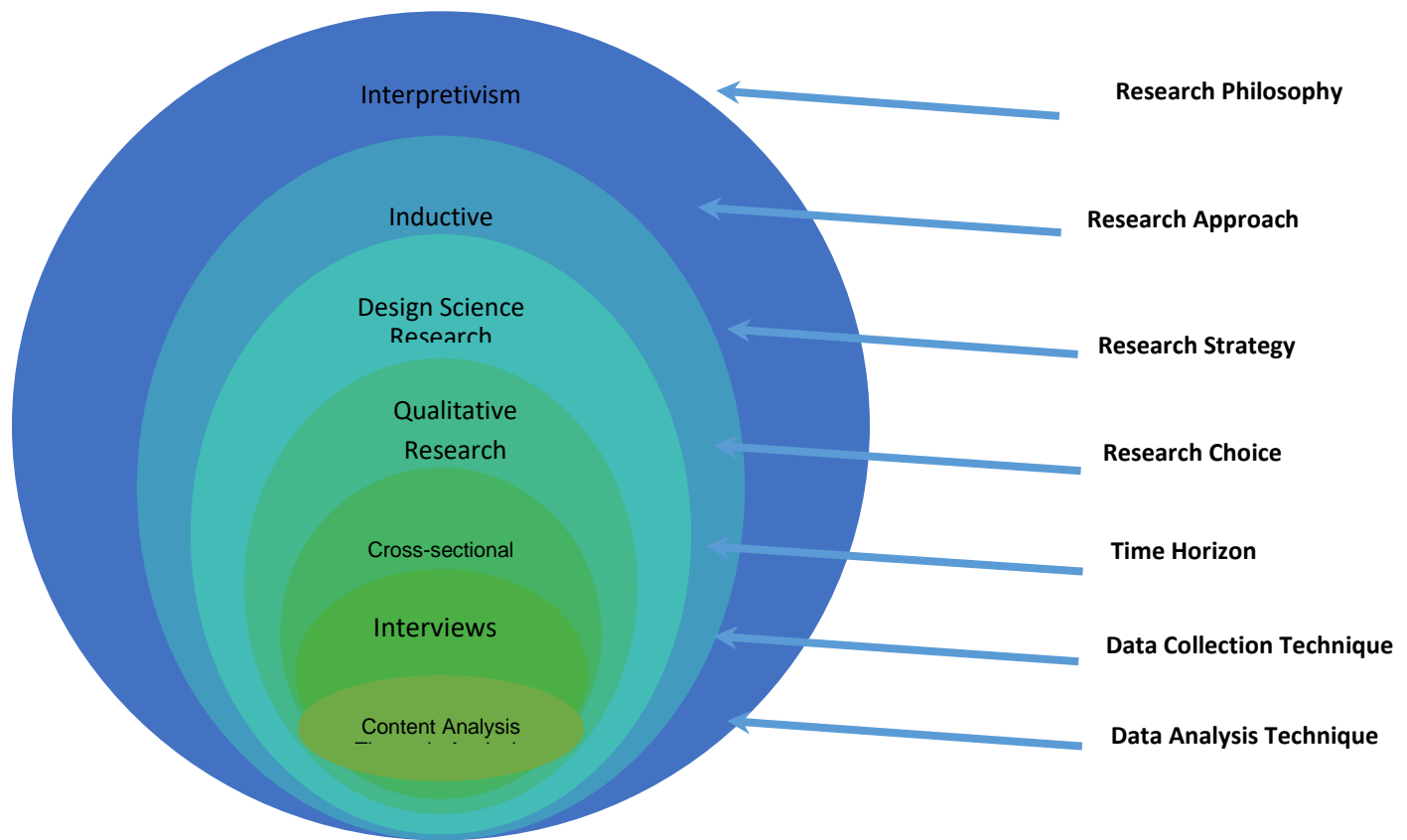
Figure 2.1: Research Onion (Saunders et al., 2019)

2.4.1. RESEARCH PHILOSOPHY

Research philosophy refers to what the researcher believes in the process of creating new ideas (Saunders et al. 2019).

In the Research Onion, the first layer is made up of the philosophy of study; this determines the nature of data collected and how it is analyzed. There are six (6)research philosophies in the Onion Model (Schwaferts, 2016). They are Pragmatism, Interpretivism, Positivism, Realism, Constructivism and Objectivism.

Positivism is the process of developing research questions and hypothesis that can be tested based on facts from observations and experiments (Goldkuhl, 2012). This philosophy aligns with the view that

knowledge can only be gained from verifiable measurements (Schwaferts, 2016). Positivism studies require the researcher to collect data in an objective manner. Often times the researcher is required to be independent of the research without any form of human bias in the study (Trochim, 2020). Traditionally, with this philosophy choice, fact is the ultimate and it is derived from an empirical observation. Positivists have five (5) guiding principles:

(i)   Logic of inquiry is consistent across sciences.

(ii)   The study should endeavor to explain and predict.

(iii)   Research should be universally true and genuine across human senses. Every generalization developed from logical reasoning should be tested during the study

(iv)   Good judgment differs from knowledge. Therefore, research findings should take precedence without the influence of good judgment.

(v)   Science must be neutral and only based on persuasive reasoning.

This philosophy embraces deductive approach whereby a hypothesis or theory is proposed, and a researcher makes observations to confirm what is factual (Dudovskiy, 2018).The data collection method is well structured, large sample sizes and measurement. It can either be quantitative or qualitative.

Realism approaches research on the basis of the reality of the situation or subject of research. It relies on the concept of independence of reality from the human mind (Dudovskiy, 2018). This philosophy takes the systematic approach in its knowledge development process and it consists of two forms: direct and critical (Žukauskas et.al., 2017).

Direct realism, sometimes termed naive realism, has to do with the notion that what one sees is what is real; thus depicting the world through the researcher's personal human senses, while critical realism maintains that humans do encounter the sensations and images of the real world (Saunders et al., 2019). It can be misleading to portray the real world via human sensations and visual images (Schwaferts, 2016).

Direct realists accept the world as relatively unchanging while concentrating on only one level of study whether it is an individual, a group or an organization. Critical realists on the other hand, appreciate the importance of multi-level study (Dudovskiy, 2018).

Objectivism deals with the interactions of social phenomenon and social actors. This creates new knowledge based on the unique experience of the observer. Objectivity is said to negate subjectivity since it renders the observer a passive beneficiary of outer information, devoid of any agency of the world that

is studied. Objectivism is defined as the function of the researcher's value. Objectivity requires an independent reality that can be grasped. If there is no independent reality, or if reality cannot be apprehended, or if reality is merely the concoction of the observer, then the notion of objectivity is questionable (Ratner, 2002)and (Saunders et al., 2019).

Objectivism combines subjectivity and objectivity because it states that objective knowledge requires vigorous subjective processes - such as perception, analytical reasoning, synthetic reasoning, logical deduction, and the distinction of essences from appearances (Ratner, 2002). Interchangeably, subjective processes can enhance objective comprehension of the world (Sanches et al., 2018) and (Žukauskas et.al., 2017).

Constructivism adopts the ideology that social actors create the social phenomena they are interested in (Saunders et al., 2019). Constructivism involves the inclusion of human mental activity in the process of investigating the real world (Venkatesh, Brown, & Sullivan, 2016). Constructivism welcomes reality as a form of human mind. Therefore reality is recognized to be subjective (Venkatesh et al., 2016). This philosophical approach is closely connected to pragmatism and relativism. It is based on observation and scientific study. So, people construct their own perception and knowledge of the world, via their experience of the world.

Types of constructivism are *phenomenological constructivism*, *biological constructivism, cognitive constructivism* and *radical constructivism* (Raskin, 2002) & (Venkatesh et al., 2016).

Interpretivism aims at understanding the knowledge gathered from social actors' interactions with their natural space especially socially and culturally while pragmatism explores different philosophies necessary (Saunders et al., 2019)and (Goldkuhl, 2012). Interpretivism requires researchers to interpret elements of a study, thus incorporating human interest into it.

Interpretive researchers' perspective is that the reality of life is experienced via a (given or socially constructed) medium or platform such as language, consciousness, shared meanings, and instruments. The criticism of positivism was the basis of the development of interpretivism philosophy (Greener, 2008).

The interpretivist rejects the objectivist approach and aligns with philosophical positions of idealism which encompass a few diverse approaches like social constructivism, phenomenology and hermeneutics. All of these stand within the context of "reality is independent of consciousness" (Saunders et al., 2019). This approach recognizes the need for the researcher to identify the cultural diversity of the people.

The interpretivist approach employs real life approach of data collection such as interviews and observations. It considers the need of the researcher to identify people as different from physical phenomena (Dudovskiy, 2018; Bhattachergee, 2012, p19). It posits that people and social environment cannot be studied in the same way physical phenomenon is studied (Chowdhury, 2014).

The most notable variations of interpretivism include:

> *Phenomenology -* here, the researcher seeks to understand the world directly or through participants experiencing the phenomena (Baillie, 2015).
>
> *Hermeneutics* – this refers to the philosophy of interpretation and understanding through studying cultural artifacts such as text e.g. biblical text, symbols, image, stories and wisdom literature (Barrett, Powley & Pearce, 2011).
>
> *Symbolic Interactionism* – this accepts pragmatist thinking and extracts meaning from the interactions between people. It focuses on the observation and the analysis of subsequent social interactions such as conversations, meetings and teamwork. This philosophy emphasizes qualitative analysis over quantitative analysis (Saunders et al., 2019).

Pragmaticism: Pragmatism is an action-based philosophical approach(Dudovskiy, 2018).This philosophy acknowledges that there are diverse ways to understand the world and investigate phenomena. It assumes that no single perspective captures the entire picture and that there may be multiple realities(Saunders et al., 2019).

Pragmaticism involves the use of a combination of data analysis – the mixed method. It gives the researcher the opportunity to explore any view in the object evaluation in order reach the target audience based on the research questions(Kaushik & Walsh, 2019).

Pragmatism allows the researcher to use any method that works in the study and thereafter communicate the findings (Venkatesh et. al., 2016). The quest to provide practical solutions ensures the pragmatist embarks on a research once confronted with a problem. The subsequent solution will influence future practice (Dudovskiy, 2018). In pragmatism research philosophy, the research question is the most important determinant of the research philosophy (Goldkuhl, 2012). Pragmatics can combine both positivist and interpretivism positions within the scope of a single research depending on the nature of the research question. It is a priority for the pragmatist to identify a practical outcome or solution instead of abstract distinction (Schwaferts, 2016).

In the same vein, pragmatism research philosophy combines the use of multiple research methods such as qualitative, quantitative and action research methods. Pragmatists use whatever combination of methods necessary to find answers to research questions(Dudovskiy, 2018).

The philosophy of this study is interpretivism because it is qualitative which involved the researcher's understanding of the context with NUST as the case study. Structured interviews, literature and expert reviews were employed for data collection and analysis. This aided the objective evaluation of the target audience based on the research questions (Adhabi & Anozie, 2017).

Table 2.2: Illustration of the Axiology of Major Research Philosophies and Relevant Methods of Data Collection (Dudovskiy, 2018; Schwaferts, 2016).

Philosophy	The Type of Value Embedded (Axiology)	Data Collection Techniques
Positivism	Research is undertaken in a human, unbiased way. The researcher is guided strictly by the positive interpretation of scientific data and maintains an objective stance. Researcher's view is totally detached from the study.	Profoundly organized, usually involves the use of large samples measurement. It can either be quantitative or qualitative research.
Interpretivism	This type of research involves the full of understanding of the context. The researcher is part of what is being researched, cannot be separated and so will be subjective.	This type of study involves small samples, in-depth investigations, qualitative research.
Realism	It is independent of the researcher's mind. His perspective is shaped by the world view. It is what is seen that is reality. Research is value laden and it affects research findings.	Methods chosen must fit the subject matter, whether quantitative or qualitative.
Pragmatism	Researcher believes in data if it supports action to improve a situation. The researcher adopts both objective and subjective points of view. The problem statement is most critical to this philosophy.	Mixed or multiple method designs, quantitative and qualitative. Researcher is at liberty to select any philosophy and methodology depending on the research question(s).

Objectivism	Focuses on facts and measurements. This is value free. Detached of axiology.	Quantitative Methods.
Constructivism	Reflection based on personal experience and relating new knowledge to previous gained knowledge.	Open-ended questions, emerging approaches, text and/or image data.

2.4.2. RESEARCH APPROACH

Research approach is influenced by the philosophy of the study and usually includes the three (3) major approaches to theory development (Saunders, 2019). They are deduction, induction and abduction(Archer, 2018). In this chapter only two are highlighted, they are deduction and induction research approaches. Most researchers use practical reasoning to unite both Inductive or deductive approaches (Glanz, Rimer & Viswanath, 2008).

2.4.2.1. DEDUCTION APPROACH

The deduction approach is employed to test a previous or existing theory (Archer, 2018). It is popular in scientific research (Dudovskiy, 2018).It uses natural laws as the basis of explanation, creates room for the anticipation of facts, gives a prediction of their occurrence and creates ability to manipulate the scenarios. It is reasoning from a specific to a broader perspective to investigate a pattern occurring in an individual case that is reflected in multiple cases.

A deductive design might test to see if a relationship or link occurs in general circumstances in a theoretical population (Venkatesh et al., 2016). In other words, the deductive approach is concerned with deducting conclusions from premises or propositions(Dudovskiy, 2018).

Application of Deductive Approach:
 In this approach, appropriate methods relevant to the study are selected by the researcher to test the hypotheses to confirm them right or wrong. These are quantitative methods such as regression and correlation analysis, mean, mode, median etc. Literature reviews are appropriate when analyzing the outcome of a hypotheses testing in order to compare findings, while modifying the theory in situations where hypothesis is not confirmed (Schwaferts, 2016).
A deductive is illustrated in figure 2.2.
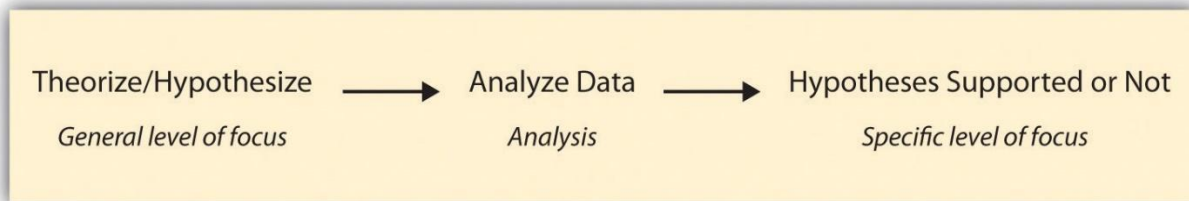
Figure 2.2 – Deductive Approach Process (Blackstone, 2012).

2.4.2.2. INDUCTIVE APPROACH

Inductive approach which is also known as inductive reasoning, "starts with the observations and theories are proposed towards the end of the research process as a result of observations" (Dudovskiy, 2018).

Inductive research engages a process of search for a pattern from the various observations made and explanation of the concept is developed (Lessard & Yu, 2012).Those patterns when explained with series of hypotheses form a theory or theories. Often, inductive studies do not apply theories or hypotheses at the beginning of the research, as depicted by the diagram in figure 2.3.
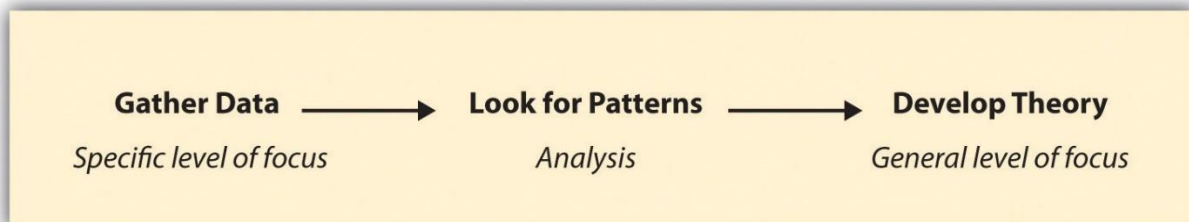
Figure 2. 3 Inductive Approach Process (Blackstone, 2012).

Application of Inductive Approach

Inductive reasoning starts with elements observations of the nature, which moves towards more outline generalizations and ideas. Inductive reasoning subscribes to learning from experience (Venkatesh et al., 2016). The approach is referred to as a "bottom-up" approach to knowing, in which the researcher uses observations to build an abstraction or describe a picture of the phenomenon that is being studied"

This study adopted the inductive approach as it entailed the creation of the theory of how to introduce persuasive strategies to facilitate the use of mHealth application for stress management among NUST students (Mathers et. al., 2002).

The inductive approach uses data generated from a research design to build or support a theory. In this study, the researcher used the Health Behavioral Change theory to evaluate the perceived stress conditions of NUST students.

2.4.3. RESEARCH STRATEGY – DESIGN SCIENCE RESEARCH

The Design Science Research (DSR) strategy can be adopted to frame research questions (Saunders et al., 2016). DSR is chosen for an investigation because of the research philosophy and artifacts required to help improve an existing situation (Peffers et. al., 2018). There are different types of artifacts. Some are tangible materials such as mHealth apps, while others are abstract like a theory or principle that contributes to knowledge (Gregor & Hevner, 2013a).

For this study, the DSR is required to develop a model to evaluate the persuasive strategies in existing mobile health apps for stress management and their efficiency when used by university students.

The types of models considered could be at different levels depending on their maturity. Maturity level 1 means the model is based on tested and established theory, while other levels can transcend from new theories to nascent or futuristic theories (Mettler, 2009). DSR is future oriented and tries to improve on human conditions. In this case, the situation is the stress condition of university students in Namibia. This work will also add to the body of knowledge relevant to professionals such as mHealth developers and designers.
DSR is holistic as it engages system thinking. It often aims at developing generic solutions to real life or field problems; in this case, stress among university studentS in Namibia. For this study, DSR is indeed a favorable strategy because it is driven by the desire to assist in solving mental health challenges like stress induced depression which sometimes leads to suicides, anti- social behavior, gender-based violence, lack of concentration that leads to poor academic performance, poor eating habits and excessive alcohol use. The researcher therefore acted as an interventionist.

Hoang Thuan, Drechsler, & Antunes (2019) posit that a framework creates the focus and limitations for desired data to be collected and evaluated. DSR is perfectly positioned to make both research and practice

improvement to the field of digital invention in the process of methodically addressing research questions (Yoo et al., 2010; Hevner, Brocke, & Maedche, 2019). It was therefore necessary and important to develop an analytical framework to answer the research questions.

There are four cycles involved in the Design Science Research process. These are Relevance, Development, Rigor and Evaluation.

Relevance Cycle: Design Science Research starts in the relevance cycle where the context is defined. In this cycle, the problem statement or opportunity and requirements are clearly stated (Hoang Thuan et al., 2019). Importantly, the acceptance criteria for evaluating results are specified in the same cycle (Hoang Thuan et al., 2019).

For this study, the limited use of stress management mHealth applications among university students was identified as the problem. Also the high (incidence) of mental health related problems in Namibia is a major cause of concern, as well as the limited availability of persuasive strategies in existing mHealth applications. The guidelines and recommendations of persuasive strategies to facilitate the use of mHealth apps for stress management is the artifact that can improve existing apps evaluated by NUST students and experts in the practice.
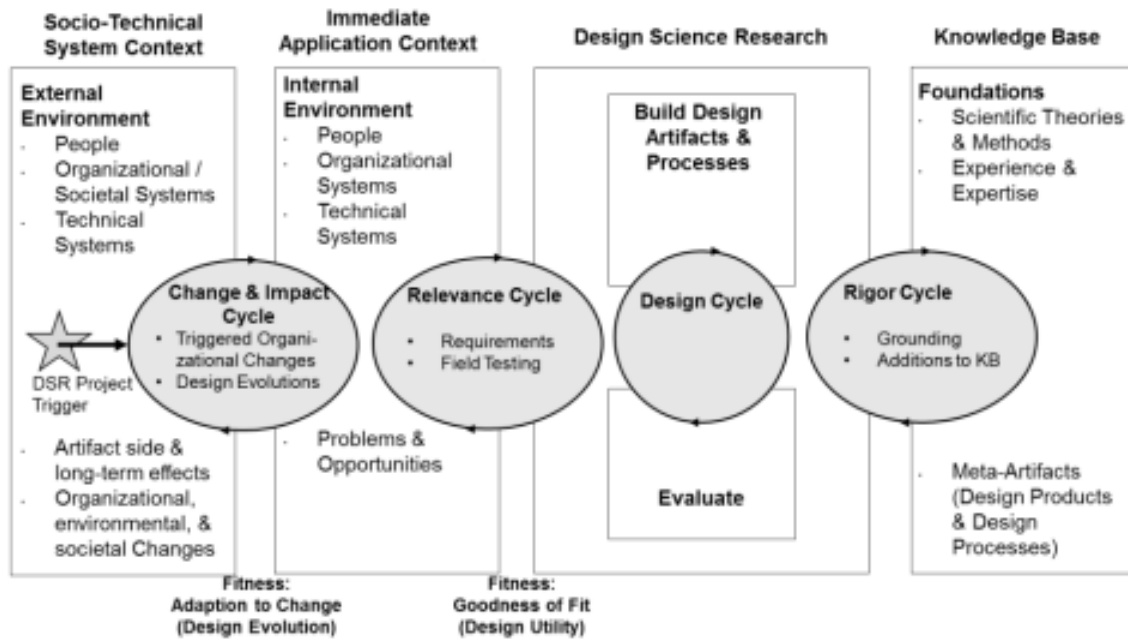
Figure 2.4: A Four-cycle View of Design Science Research –DSR (adapted from Drechsler & Hevner, 2016).

Rigor Cycle: The rigor cycle provides existing knowledge to a research project. This is a distinguishing feature of the Design Science Research(Hevner, 2007). The knowledge-base provides a basis for rigor. It is important that the researcher skillfully selects appropriate theories (Hevner, 2004) and methods. Then, they are applied to the design of existing mHealth apps for stress management to identify needed innovation through iterative evaluation (Gregor & Hevner, 2013a). This way, the research will be thorough. This research adds to knowledge by applying Design Science Research in developing the practical design template for stress management mHealth applications for university students in Namibia.

Design Cycle: This is the core of the project where most of the work occurs (Hevner et al., 2004). Design Science occurs in an existing context. It is grounded on a knowledge base which includes relevant scientific theories and models. For this cycle, the requirements are input from the relevance cycle and the design; while the evaluation theories and methods are drawn from the rigor cycle(Venable, 2006). The design cycle involves rapid, iterative construction and evaluation of the artifact and the resultant feedback is used to refine the artifact. Characteristic of this cycle is the design of alternatives which are evaluated against requirements until a satisfactory design is achieved (Hoang Thuan et al., 2019) and (Drechsler & Hevner, 2016).

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In this study the design cycle involved the development and evaluation of the guidelines for persuasive strategies to integrate in existing mHealth applications for stress management among university students in Namibia (Cronholm & Göbel, 2016).

Change and Impact (CI) Cycle: The fourth cycle referred to as the Change and Impact (CI) cycle) (Drechsler & Hevner, 2016) is necessary when researchers consider the secondary or longer-term impact of artifacts in and on societal environments. The fourth cycle accommodates the difference between the primary context of design which is a small unit of the larger society and the global effect of larger systems as well. For this work, NUST is the case study.

The cycle gives the opportunity to evaluate unforeseen long term implications of the evaluation of the primary artifact design(Drechsler & Hevner, 2016). It also gives room for the continuous change and innovation recorded along the process documentation.

Saunders et al. (2016) posit that Design Science Research is relevant for framing research questions. It is suitable for behavioral science related studies and is appropriate for evolving information systems. Unlike other philosophies it is real world practice oriented and problem centered.

Application of Design Science Research

Design Science Research Methodology (DSRM) highlights the design and construction of appropriate artifacts such as guidelines, framework, applications, methods etc that can possibly improve the efficacy of the intersection of people and technology (Hevner et al., 2004; Peffers, 2007). Its unique feature stems from its reliability to deliver practically useful artifacts (A. Hevner et al., 2019)

Phase 1: Literature Review – The first phase as illustrated in Figure 3 below, discusses the literature review to evaluate existing literature to identify a list of persuasive elements in mobile apps for stress management. It used the Joanna Briggs Institute and PRISMA ScR protocols to report the study. The review also enhanced the understanding of effective persuasive strategies commonly used for mental health-related mobile apps as well as persuasive strategies used in developing countries. It gave reviews of recent work in persuasive technology and strategies in Namibia and developing countries, identifying more than fifteen (15) persuasive strategies in about fifty (50) studies evaluated.
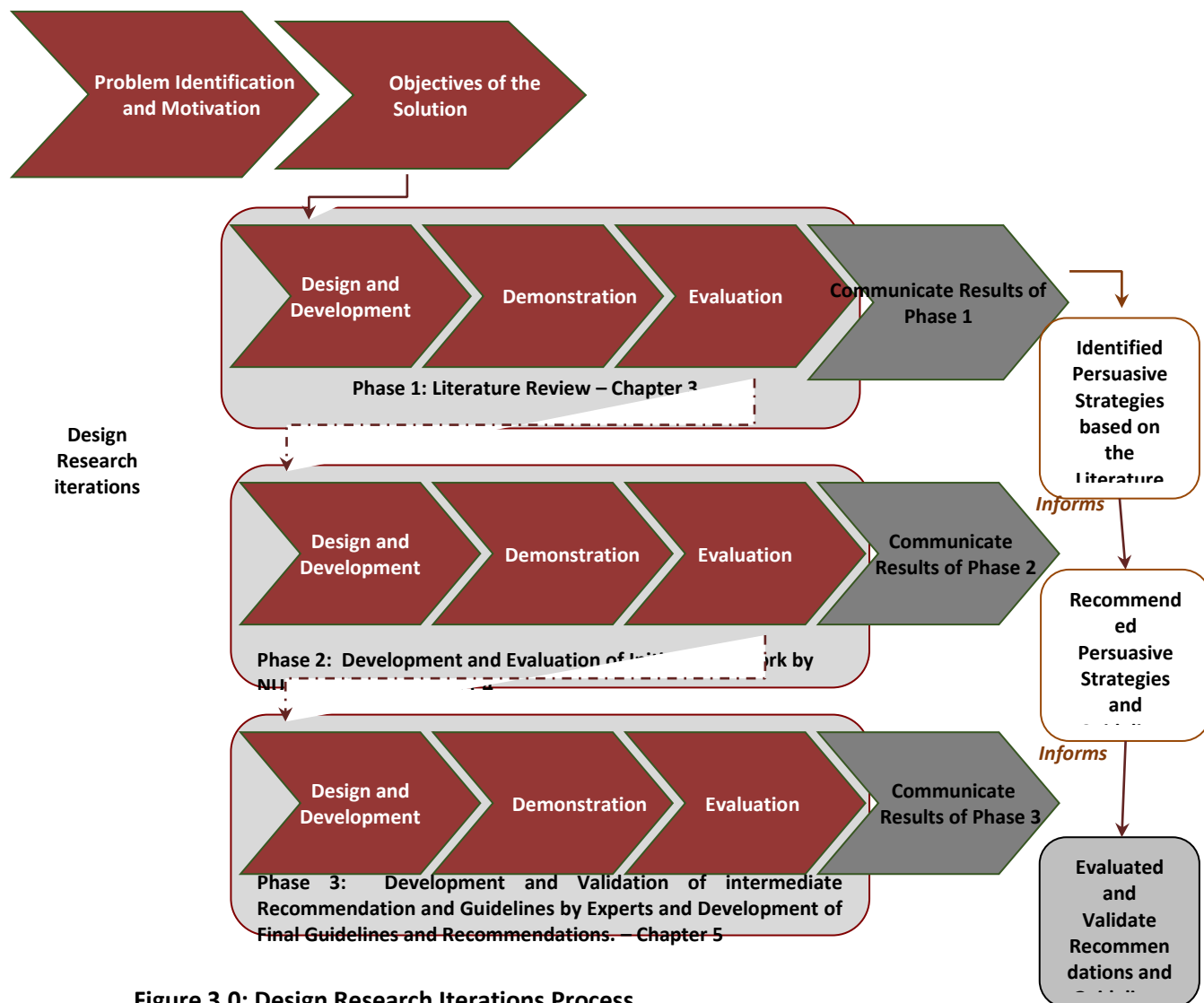
Figure 3.0: Design Research Iterations Process.

Phase 2: Student Interviews – An interview protocol was developed with the identified list of persuasive strategies. The interview questions were developed with a selected list of context relevant elements of persuasive strategies to determine which of them applied to NUST students. The outcome of the interview was a list of elements of persuasive strategies found to facilitate the use of mHealth apps for stress management by the students. It also included additional components as revealed by the interviews conducted and draft guidelines developed.

Phase 3: Interviews with Professionals - Elements Strategies derived from literature and the students were reviewed by the mHealth apps developers and professionals in the mental health space. The elements of persuasive strategies and guidelines were evaluated to measure their efficacy in facilitating the use of mHealth for stress management among the students.

Table 2.3 presents guidelines on how to conduct Design Science Research based on guidelines by Hevner et al (2004). It itemizes each guideline with the corresponding description and explanation on its application.

Table 2.3. Application of Design Science Research Guidelines to the study (Hevner, 2004).

Guidelines	Description	Application to the Study
Guideline 1: Design as an Artifact.	Design Science Research must result in the creation of a practical artifact in the form of constructs, models, methods or instantiations.	The study identified the elements of persuasive strategies in mHealth applications for stress management in current literature.
Guideline2: Problem Relevance.	Design Science Research aims at building up technology-based solutions to inherent and relevant business problems.	The problem identified in this study referred to the lack of use of mHealth to support the mental health of students.
Guideline 3: Design Evaluation.	The design artefact must be thoroughly evaluated through well-executed methods to yield utility, quality and usefulness.	The guidelines and recommendations were refined in three different phases.
Guideline 4: Research Contributions.	Design Science Research needs to offer new and acceptable contributions in the fields of design artifact, design foundations and/or design methodologies.	The guidelines and recommendations capable of persuading students to use mHealth for stress management and instructional to developers, designers and experts of mHealth apps for stress management and mental health.

Guideline 5: Research Rigor.	Design Science Research employs rigorous methods in the construction and evaluation of the design artifact to ensure coherence and consistency.	To maintain rigor and validate the elements of persuasive strategies in mHealth applications relevant to support stress management among university students in Namibia as determined by professionals in mHealth practice.
Guideline 6: Design as a Search Process.	The creation of an effective artifact requires consideration of the problem environment and mechanisms that can find an effective solution.	Literature review was used to identify elements of persuasive strategies to facilitate the use of mHealth apps for stress management among NUST students.
Guideline 7: Communication of Research	Design Science Research must be Communicated effectively to technology-oriented as well as management-oriented audiences.	Some of the findings of the study have been published in the form of conference papers, workshop and journal articles.

2.4.4. RESEARCH CHOICE

The researcher used mono qualitative method. Since the study involved qualitative data which included interviews, the qualitative approach was primarily used for exploratory research. This deepened understanding of the reasons, motivations and choices behind the study.

Qualitative data was collected through literature review, semi-structured interviews, focus group discussions as well as qualitative opened ended questionnaires. The findings were analyzed using content analysis and theme analysis.

2.4.5. TIME HORIZONS

Time horizon layer defines the time frame of the research. Time horizons often consist of two (2) options:

- the cross sectional study which involves short term data collection (Schwaferts, 2016).

- the longitudinal option which involves repetitive data collection over a long period of time (Melnikovas, 2018).

This study adopted the sectional time horizon because of time limits since it considered students' experience within a certain time frame which was during their active years in the university (Saunders et al., 2019).

The next section describes the data collection process.

2.4.6. DATA COLLECTION TECHNIQUES AND PROCEDURES

The data collection process is presented in this section.

- **Data Collection and Analysis**: There were Focus Group Discussions and interviews involving diverse segments of the NUST student population. The discussions were to evaluate identified persuasive strategies. Open-ended questions were combined with other interviewing techniques to explore the topic in detail, understand students' stress management processes, and identify the potential causes of observed patterns. This assisted in investigating the reasons for the observed behaviors (Iyawa, Herselman & Botha, 2019).

  Qualitative open-ended questionnaires developed with the findings from the literature were administered and evaluated. Thematic analysis was conducted to identify what were relevant persuasive strategies required for mHealth apps for stress management (Weller et al, 2018).

  Questionnaires were used to gather information on users' desirability to use a certain mHealth application for stress management. There was data analysis to form content and theme. Finally, the recommendations and guidelines developed were evaluated by field experts.

  Case Study: A case study design involves an extensive study of one or more individuals or cases in a real-life context. The data that is collected may include watching aspects of their behavior or of the setting, interviews with participants and record searching. Simply put, "a case study can be defined as an intensive study about a person, a group of people or a unit, which is aimed to generalize over several units" (Heale & Twycross, 2018).

  A case study is a popular research methodology in the social and life sciences. It requires a unit of analysis, which is the case to be defined. A unit of analysis is the case or group of cases on which

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data collection focuses in order to enable the researcher to draw conclusions (Venkatesh et al., 2016). The most apposite design is then selected, and the appropriate theory applied to the design (Hoang Thuan et al., 2019) . This involves selecting a set of procedures for designing, data collection and analysis, presentation and reporting the results. This research considered a couple of case studies.

- **Interviews:** Interviews may be structured, semi- structured or unstructured.   Structured interviews work with a list of predetermined questions. Respondents can develop answers which are recorded and transcribed as text.

  Semi-structured interviews on the other hand involve natural interaction like approach, with the interviewer armed with a checklist of topics to address and he works through them (Zorn, T. 2008).

  In unstructured interviews, identified issues are discussed in general terms in a free-flowing manner, without restrictions or limits. Unstructured interview gives the interviewee the liberty to talk freely about practically anything that arises. Interviews can be with individuals or with groups (SAGE Publications, 2017). Semi-structured interviews are appropriate when collecting data for exploratory research or attitudinal information just like the human behavior in response to stress.

  The researcher developed an interview protocol and used structured interview format. There were twenty-three (23) pre-selected questions developed for both students and expert interviewees to identify persuasive strategies in mHealth apps for stress management. Attention was given to the phrasing of interview questions so that they were not leading to subtle persuasive questions, responses or explanations (Creswell, 2014).

2.4.7. DATA ANALYSIS

Qualitative Data Analysis

Non numerical and unstructured data are termed "qualitative data" especially in the social sciences (Luczun, 1988). It is mostly used for exploratory studies; which means the researcher will gain a deep understanding of the reasons, motivations, context and choices behind the research (Mohajan, 2018).

The objective of qualitative data analysis is to discover emergent themes, patterns, concepts, and understandings (Suter, 2014). Most qualitative data analyses are based on the similar basic principle: identifying the common patterns (Archer, 2018). The various methods used to collect qualitative data for this study include literature review and structured interviews conducted among NUST students. Subsequently interviews were conducted with developers of m-health apps and mental health counsellors. The findings were analyzed using content analysis after interviewees' responses were categorized into "Yes" or "No".

Population and Sample

Different studies have different definitions of population as indicators of representativeness. They are often clear in their description of the target population. For example in the field of statistics, population is an entire group about which some evidence is required to be established, the sample (inclusion and exclusion criteria), motives why certain eligible individuals choose not to participate, and any attempt to achieve a sample of participants that represents the target (Banerjee & Chaudhury, 2010).

A sample is a part that represents the target population. It is important for the researcher's inference about the group to be based on the information derived from the sample (Mohajan, 2018). It is common practice in qualitative studies to identify a study population and then make observations on a sample taken from the population (Banerjee & Chaudhury, 2010). The targeted population of university students in Namibia was recruited. They were full-time members of the NUST academic student community based in Windhoek. They were students that had smart phones, had internet access and were conversant with their use.

The research sample was decided based on saturation. Saturation is attained when the researcher does not find anything different in the search since there is always a search for new instances of interest (Mohajan, 2018). For this study, the interviews stopped when data was being repeated after the thirteenth (13th) interview. The participants included both male and female students.

2.5. SUMMARY OF CHAPTER

This chapter mapped the research questions to the objectives. It also explained the research design adopted to answer the research questions. The philosophy adopted in this research was interpretivism and it was a qualitative methodology in data collection and analysis.

CHAPTER THREE

LITERATURE REVIEW

3.1. INTRODUCTION

This chapter provides a literature review of elements of persuasive strategies to facilitate the use of mHealth apps for stress management. It highlights the Phase one of the iterative process.

The objective of this chapter is:

- **To investigate the elements of persuasive strategies in mHealth applications for stress management in the current literature.**

To answer the first sub- research question:

- **What are the elements of persuasive strategies in mHealth applications to support stress in the current literature?**

This literature review which is Phase 1 is illustrated in figure 3.1.

Figure 3.1 - Phase 1 of the Iterative Process of DSR Highlighted in Brown,
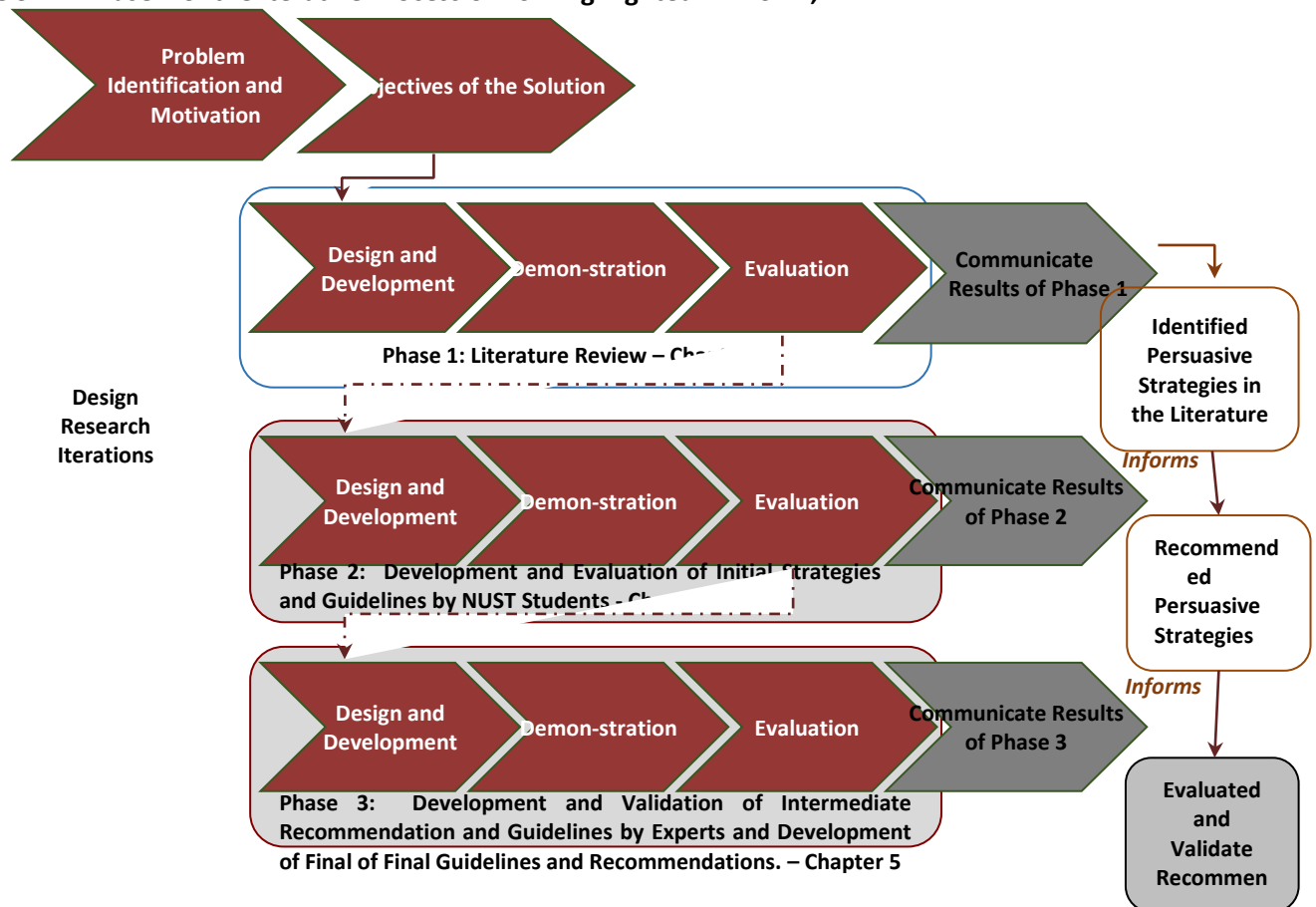
A literature review is simply a summary of academic resources relevant to the field of research being investigated (Rowley & Slack, 2008). It is always organized and entails some analysis of the existing knowledge in order to create a new understanding (Cronin, Ryan, & Coughlan, 2008).

The literature review combines both summary and synthesized data from different sources to create coherent information. There are different types of literature reviews, majorly divided into unstructured (traditional literature review), structured (systematic literature review), meta-analysis and critical literature reviews (Kraus , Breier & Dasí-Rodríguez, 2020). A systematic literature review recommends and a detailed methodological approach is necessary. In any kind of literature review, there is limited application of the rigid guidelines in qualitative research (Baillie, 2015).

The literature review for this study has the following sections: explanation of the search strategy, definitions, classifications, presentation and discussion of major theoretical frameworks and models. It also engages discussion of contradictions in the research area conclusions.

This chapter addresses the research sub-question (section 1.4)

- **What are the elements of persuasive strategies in mHealth applications to support stress in the current literature?**

This chapter also addresses the research objective described in chapter 1 (section 1.5).

- **To investigate the elements of persuasive strategies in mHealth applications for stress management in the current literature.**

There is also a detailed analysis of the available elements of persuasive strategies in the existing literature by other authors, to the research area. This method was selected because of the qualitative research nature of the study and it is structured as indicated in Figure 3.2.
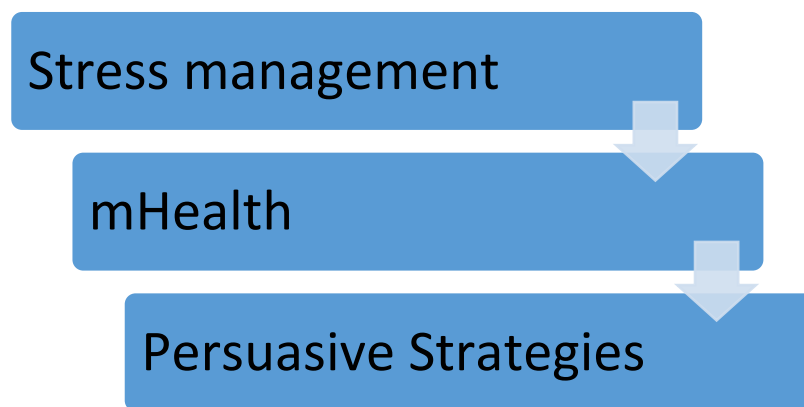
Figure 3.2 Literature Review Process.

3.2. STRESS AS A CONDITION

Stress is defined as pressure from the environment and its subsequent strain from within a person (Giota & Kleftaras, 2014). In recent times a more acceptable definition is that stress is the interplay of factors between an individual and the situation around him (Lee, Kim, & Wachholtz, 2016). It has been reported that stress occurs when the psychological and physiological state or resources of a person is deficient to handle a situation (Sharma & Rush, 2014).

Stress can be productive or destructive depending on how it is managed (Jeffrey A. Kottler & Chen, 2018) and (Michie, 2002). Managing stress is a serious challenge among college student populations across the US especially female students who are vulnerable to the negative effects of stress (Jeffrey A. Kottler & Chen, 2018). It was also discovered that they tend to resort to poor means of coping with their stress (Crandall, Miller & White II, 2018).

Stress has become a growing problem that is affecting many people and with significant impact on the quality of life (Carissoli et al., 2015). According to the study, most people resort to self-help without contacting professionals. Since it is important to know how to deal with stress, some degree of success in stress management techniques as well as reduction in stress indications has been recorded. However, the need for innovation was considered as mobile phones become ubiquitous and instrumental in many self-help interventions.

Mental disorders are rampant among university students according to the statistics of the National Survey of College Counselling Centers in the United States and Canada (Hall et al., 2018) and a similar trend was

reported among Chinese students as reported in the study. The prevalence of depression was as high as 32.6%, anxiety was 16.3% and poor quality of sleep was 9.8%. All these point to the implication of poor stress management and direct implication (Hall et al., 2018).These results were clearly shown in this randomized trial of Chinese university students. The absence of treatment of participants exposed to stress might have led to worsening perception in their stress conditions (Carissoli et al., 2015). Hall et al. (2018)'s study gave staggering statistics on students; those with stress issues tend to have difficulty with interpersonal relationships, poor health and academic performance unlike the students who did not report stress issues. Over 90% of mental health counselors reported a rising pattern of students suffering from mental health issues as indicated by a 2014 national survey of college counselling units in the US and Canada.

An investigation done in 2013 showed that daily physical activities on campus produced stress which may lead to physical ailments, psychological distress and poor academic performances (Malott, Vishwanathan, & Chellappan, 2013). Outstanding academic performance is almost impossible with poor management of stress by university students (Carissoli et al., 2015).

3.2.1   STRESS MANAGEMENT TECHNIQUES

Mindfulness is one of the useful ways to manage distress conditions (Ramli et al., 2018). Hall et al., 2018) operationally defines it as "the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding experience moment by moment".

Mindfulness meditation can be described as a process of bringing a certain quality of attention to moment-by-moment experience, which has been a useful psychology approach to address mental health processes to treat stress maladaptive behavior (Cachia, Anderson, & Moore, 2016).

Low level psychological meditation is encouraged if it aligns with clinical standard practice for stress if properly administered by a lowly qualified health worker with little or no clinical experience (Hall et al., 2018). This makes access to more counsellors possible. In view of more students - counsellors imbalance ratio on university campuses, there is increasing need for mental health services as students hesitate to use university in-person counselling centers because of lack of staff and the stigma associated with mental health conditions. Students' hectic schedule also make them resort to self-help (Levin, Krafft, & Levin, 2018). Only a very small percentage of the student population takes advantage of the university health facility.

Malott et al. (2013) stated that Depression Anxiety Stress Scales (DASS) was the scale used to evaluate an individual's level of self-reported stress in multiple studies reviewed. Pittsburgh Sleep Quality Index (PSQI) was also used to evaluate the quality of sleep experienced by an individual. This was a useful stress level indicator.

Mindfulness has achieved good results in reducing levels of stress, anxiety and depression (Carissoli et al., 2015). Other positive means of managing stress include breathing exercise, physical exercises like walking or jogging, listening to music, social interaction like speaking to someone and relaxation (Lane et al., 2014; Arshad et. al., 2019).

3.2.2. mHEALTH DEFINITIONS

Mobile Health or mHealth was succinctly described by WHO as "medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants and other wireless devices" as means to access prevention, and promotion of healthcare services during the 71st World Health Assembly Director General's Report in March 2018 (WHO & ITU, 2017).

Health infrastructures are not readily accessible especially for mental health conditions. For instance, due to the limited number of counsellors and stigma attached to mental health conditions, students barely visit university counselling services. Hence the mobile phone which is readily available among students becomes a suitable means of reaching this technology friendly population. It is a tool the target audience is readily accustomed to. The ease of use of the technology is high.

The ubiquitous nature of the mobile phone has made it an appropriate tool for the student population. Mobile phones can be used in both public and private without violating individual students' privacy and at their own discretion. This makes it appealing to the target population as reported by Zakaria et al., (2019). So, mHealth can be further defined as the use of mobile phone applications such as text messages as reminders, content for meditation, trackers for physical exercises, social connections apps, games, stress coping contents, reminders to help student be conscious of their stress conditions.
Mobile health is not new. However more investigations are required to explore mental health themes. The two recommended modes of using mobile health applications are health promotion and prevention (Bol, et al., 2018).

During patient treatment, mobile application provide a unique opportunity to get the patient ready and prepared beyond the usual. Patients are enlightened about their conditions via knowledge provided in the app as deemed fit by the health worker, prior to enrolment of the patient and during enrolment (Price, et al.,2014).

Realtime video capacity of smartphones has pushed the boundaries of mHealth in healthcare, providing immediate access to patient - healthcare professional interactions (Price et al., 2014). The use of mHealth applications in multiple studies of stress management among university students has taken different forms and shapes such as tracking of quality of sleep, planning mindfulness, sensors for psychophysiological changes, reminders for physical activities and breathing routines.

With the Telecommunications Sector Performance Review (SPR) 2016, the Communication Regulatory Authority of Namibia (CRAN, 2017) report put the number of mobile phone SIM card subscribers at 2.66 million, which is over 100% of Namibian population(O'Dea et.al., 2020). The report also indicated that about thirty – one (31%) of this population has access to smartphones with a projection of that number doubling. Mobile health provides a suitable means to reach student populations with constant availability and greater access. Another study further illustrates how mobile health helps patients overcome the structural constraints easily besetting them from accessing care for their conditions (Lucivero & Jongsma, 2018).

The dramatic proliferation level of mobile devices and wireless communication technology use has significantly affected the growth of mobile commerce in recent years (Aung et al., 2016).

MHealth apps for health have proven to be more engaging for mental health care specially to provide information and awareness required to manage the conditions with limited exposure to stigma especially among young adults (Price et al., 2014; Giota & Kleftaras, 2014).

mHealth being the use of mobile phones to deliver health with the use of software applications deployed to cell phones and handheld devices makes it represent a new frontier for delivering mental health treatment (Giota & Kleftaras, 2014). Istepanian & Al-Anzi, (2018) also define mHealth as mobile computing, medical sensors and communication technologies for healthcare.

In the context of this study, mHealth is the use of mobile phone and mobile phone health applications to support stress management. This could be interventions that include text messages, voice calls, mobile

social media apps and native mobile apps that can support stress management and improve students'
stress situations.

3.2.3. mHEALTH APPLICATIONS FOR STRESS MANAGEMENT

There have been remarkable gains made in the use of mobile health to address stress and anxiety among
students (Orji et al., 2018; Arshad et al., 2019; Lee et al., 2011). mHealth usefulness consists of students
maintaining their mental health treatment as health workers can connect with patients directly and
administer care or sessions remotely (Kao et al., 2018; Hall et al., 2018). At the same time, patients
become empowered during the care (Aryana, et al., 2019).

Another success experienced with mHealth is the mindfulness compared to self-help. Significantly, using
mHealth to address stress management among students with mobile applications for monitoring an
individual's stress level has become highly popular and they range from those used for self-reporting to
those which use sensors to pick physiological changes. These mHealth apps have also proven to have
achieved some successes in alleviating the stress conditions of participants. More students or individuals
have accessed mental health care services than would ordinarily have done so. Previous literature have
captured some of these successes (Lucivero & Jongsma, 2018). Enhanced texts, reminders with memes
and other multimedia messages proved to be more successful with students (Hall et al., 2018).

3.3. PERSUASIVE TECHNOLOGY (PT) FOR STRESS MANAGEMENT

The use of technologies to influence people's behaviors has been a topic of interest among researchers
(Kampik,et al., 2018). Studies have provided different descriptions for persuasive technologies (PTs)as
computerized software designed to change behavior with neither coercion nor deception (Orji &
Mandryk, 2014). Also there is the concept of making people have ideas of future events through the use
of computer systems simulation techniques. Persuasive technology can also be described as any
computing system, device, or application intentionally designed to change a person's attitude or behavior
in a predetermined way (Handayani, Meigasari, Pinem, Hidayanto, & Ayuningtyas, 2018) described
persuasive technology as any technology developed with the intention of directly influencing change in
attitude. The widely accepted definition of persuasive technology is whenever technologies are used to
change behaviors and attitudes of end-users through persuasion and social influence without coercion
(Fogg, 2009).

Principles of Persuasion

According to Cialdini, (2001), there are six (6) principles of persuasion.

(i)   **Commitment and Consistency** - the resolution of an individual to make a change. Even when the initial motivation is removed, the individual is still committed to the cause.

(ii) **Authority** - verifiable facts motivate people to act.

(iii) **Reciprocity** - Rewards, incentives and favor act as persuasion to act.

(iv) **Liking** - People are easily influenced by personalities they adore.

(v)   **Scarcity** - limited supply of a commodity increases the demand for it. This strategy plays out during Sales.

(vi) **Societal Social Attestation or Proof** - Individuals tend to do what others are doing (Qasim et al., 2018).

Persuasive technologies have been used in different areas. They can be used in schools or external environments to motivate people to acquire new knowledge or skills (Devincenzi et al., 2017a). The use of this technology has also gained momentum in different aspects of life - from sales, politics (Lee et al., 2011), the military (Hart & Klink, 2017), entertainment (especially gaming) and sports (Fogg, 2009). There is a game based persuasive technology that increases knowledge and awareness about waste management, providing pathways for restructuring waste segregation behavior (Bardhan et al., 2016; Orji et al., 2018).

Persuasive technologies have also been used for facilitating behavioral change in health (mental health). There was a pilot implementation of persuasive technology using an interactive diary for autistic teenagers to enhance their social interaction, while enhancing their attention preferences, motivation and cognitive processing (Ranfelt, et al, 2009). It has also been deployed for smoking cessation, physical activity, anxiety management and health games (Bascur et al., 2018 ; Orji & Mandryk, 2014; Sharma & Rush, 2014). From studies, behavioral change strategies have made positive impact on health (García-Banda, 2010).

Different approaches have been taken to incorporate persuasive technologies in addressing stress management (Dennison et al., 2013). Most mobile applications for stress take the route of mindfulness of the stress condition by the individual, ensuring that the awareness of the situation is the first step as well as encouraging the user to be conscious of their state of mind, by evaluating the emotional state or

present circumstance (Ptakauskaite, Cox, & Berthouze, 2018). Others sense the physical attributes of the users such as blood sugar level, cholesterol level, breathing rate or heartbeat rate in order to trigger a message to the user and thereby recommend he next steps (Jung et al., 2016).

There are mHealth applications that give evaluations and based on users' responses, recommend applicable options (Lieto & Vernero, 2014). There are also mHealth apps that monitor levels of physical activities or mobile device engagement by the user to decide the stress management therapy Coulon, Monroe,& West,2016). Despite the different approaches these mobile app designers take to engage persuasive technologies for stress management, it is still difficult to ascertain the point when the interventions work. There are obviously different outcomes for different individuals(Dennison et al., 2013). Some PTs use embedded goal setting activities to help individuals to achieve health behavior change with the understanding that an individual's lifestyle or activities have impact on their health status. This involves a complex process even if the change required is a single behavior change (Young, 2014). The use of mHealth applications have been found to be useful in achieving some level of behavior change if it aligns with an individual's lifestyle(Dennison et al., 2013a).

Persuasive strategies are made up of different ways persuasion have been applied to motivate behavior change/or attitude change depending on the prevailing context (Orji, 2014, p75; Coulon et al.,2016). Kientz (2010) discusses eight (8) strategies sorted into four general approaches.

3.3.1a - Persuasive Strategies - Instruction Style

Authoritative: This scenario involves using a change agent like a mentor or teacher who is disciplined to persuade the user to use the technology. An example could be a fitness coach. One of the roles of this individual is goal setting (Qasim et al., 2018).

Non-Authoritative: In contrast to the authoritative style, in this case, a peer or a colleague who is more like an accountability partner persuades an individual towards achieving a goal without using authority. He could be a friend or a family member who motivates the user to meet their goals.

3.3.1b - Persuasive Strategies - Social Feedback

Here, an individual's behavior is influenced by others around him in different ways. Kientz, 2010 highlighted two (2) forms of social influence:

Cooperative: This involves the process of persuasion with group work for a common goal. For example, a group of users form a group to achieve a task.

Competitive: With this strategy, a user is persuaded through a competition with others. For example, users can play against friends or peers and be motivated to achieve their goal by winning the competition.

3.3.1c - Persuasive Strategies - Motivation or Reward Type

Extrinsic: This is when users are motivated to take an action using external influences such as gifts, rewards, and/or trophies. They win for completing a task(Kientz,2010).

Intrinsic: The user is persuaded through internal motivators. For example, the good feeling a user would have for being healthy, or for achieving a goal.

3.3.1d – Persuasive Strategies - Reinforcement Type

Negative Reinforcement: This is the situation where a user is persuaded by removing an aversive stimulus. For example, a brown and dying nature scene turns green and healthy as the user conducts more healthy behaviors(Adaji et al., 2018).

Positive Reinforcement: Persuade the user by adding a positive stimulus. For example, adding flowers, butterflies, and other nice-looking elements to any empty nature scene as the user conducts more healthy behaviors(Lieto & Vernero, 2014).

3.4. ELEMENTS OF PERSUASIVE STRATEGIES TO FACILITATE THE USE OF MHEALTH APPS FOR STRESS MANAGEMENT

According to Moher et al., (2016), the literature review search process for elements of persuasive technologies are as follows:

- **Introduction:**   The rationale for the review in the context of existing literature is presented. The questions to be addressed with reference to participants, interventions,   comparisons, outcomes, and study design are stated (Moher et al., 2016).

- **Methods:**   This section details the protocol used; and indicates if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provides   registration information including registration numbers(Cronin et al., 2008).

- **Eligibility Criteria:**   This specifies the study characteristics (e.g., PICOS, length of follow-up)

and reports characteristics (e.g., years considered, language, publication status) used as criteria for eligibility; give rationale.

- **Information Sources:** All information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.

- **Search:** Full electronic search strategy for at least one database, including any limits used is presented, so that it can be repeated.

- **Study Selection**: The process for selecting studies is described by the researcher. (i.e., screening, eligibility, included in the literature review (Moher, et. al., 2016).

- **Data collection Process** The researcher describes the method of data extraction from reports and any processes for obtaining and confirming data from investigators if applicable.

- **Data Items:** These are listed and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.

- **Risk of Bias in Individual Studies:** Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis (Cronholm & Göbel, 2016).

- **Summary Measures**: State the principal summary measures (e.g., risk ratio, difference in means).

- **Synthesis**

of Results: Full description of the methods of handling data and combining the results of studies, if done (Moher, et. al., 2016).

3.5. INTRODUCTION – LITERATURE REVIEW

In order to succeed with the goal of identifying the elements of persuasive strategies, the literature review adopted the working definition of Persuasive Elements thus: Element is a "component or constituent of a whole or one of the parts into which a whole may be resolved by analysis" (Merriam-Webster's Collegiate Dictionary, 2020).

According to Oxford Learners Dictionary (2020), an element is "… a necessary or typical part of something; one of several parts that something contains". It is an essential or characteristic part of something abstract. Synonyms of Element that can be considered include component, constituent, factor, feature, ingredient, and unit. It is any of the fundamental substances that consist of atoms of only one kind and that singly or in combination constitute all matter.

In the context of this study, persuasive elements represent the features engaged or used by mHealth apps for stress management. According to the World Health Organization (WHO), over three hundred (300) million people of different age groups are affected by stress related conditions and a significant number of these population do not receive treatment (Arshad et al., 2019). Stress has become a growing problem and is a negative condition that is affecting many people with significant impact on quality of life (Carissoli, Villani & Riva, 2015). Positive means of managing stress include breathing exercises, physical exercises like walking or jogging, listening to music, social interactions like speaking to someone and relaxation.

Due to the ubiquitous nature of mobile phones, it has found usefulness in stress management, by helping to enhance meditation (Zhang, Schmidt, White, & Mulvaney, 2018). There have been notable gains made from the use of mobile health to address stress and anxiety in recent years (Hoffman &, Corininna, 2017). The mHealth usefulness consists of the use of mHealth applications serving as reminders to maintain their treatment with counselors or health workers, who patients can connect with directly (Rahimi, Menear, Robitaille, & Légaré, 2017).

The apps apply persuasive technology to encourage their users adopt behavior change. Persuasive technology can therefore be described as any computing system, device, or application intentionally designed to change a person's attitudes or behavior in a predetermined way (Devincenzi et. al., 2017).

Harris et al., (2017) described persuasive technology as any technology developed with the intention of directly influencing change in attitude.

Previous systematic literature review conducted by Wang et.al. (2018) reviewed the growing number of mobile applications for monitoring and managing stress related disorder symptoms among university students. However, clinically validated evidence for most of them is unclear. Their benefits to patients on long term use are thus debatable (Aryana et. al., 2018). The study discussed includes research between May 2013 and December 2017 and five (5) databases were used in the literature search. The researcher's work included seventeen (17) publications that reported a total of sixteen (16) mHealth applications for mental health management. Wang et.al (2018)'s findings were promising because digital health provided a means to reach populations ordinarily difficult to reach.

Increased engagement with the projected 6.1 billion mobile phones users by 2020 (Qureshi R., 2015), continuous monitoring capabilities of these devices cannot be ignored in effective healthcare delivery sector and ability to cover geographic boundaries. Despite all the potentials mHealth apps for stress management offer, there is still limitation on the sustainability of behavioral change and scientific evidence of the impact or efficacy of use of mHealth application for stress management. Most of the publications are predominantly investigating populations in developed countries with robust information technology infrastructure. The review was silent on the impact of culture and developing countries (Wang et.al, 2018).

Considering previous systematic literature reviews of the use of mHealth application for stress management revealed the introduction of many mHealth applications to manage physical activity, diet, sleep, stress and smoking; all with attempts to change individuals' behaviors. The articles reported various interventions focusing on three (3) areas of health interventions (physical activity, diet and sleep) and limited combined review of these health intervention focus areas in the selected articles. The literature review mapped research done using mHealth applications targeting only the selected focus areas of interventions and investigated their inter – relationships.

3.6. PERSUASIVE STRATEGIES, MODEL AND THEORIES

There is a considerable amount of literature on persuasive strategies in the past twenty (20) years of research and it has resulted in the development of multiple persuasive strategies. Some of the mentioned strategies include Caldini (2004) which has about six (6) principles, Fogg (2003) has seven (7) PT items,

while Oinas-Kukkonen & Harjumaa (2009) consolidated on Foggs (2003)'s strategies to develop twenty – eight (28) persuasive system design principles.

Persuasive strategies are often combined in PT mHealth apps designs. The selected elements are based on the designer's intuition, choice and suitability of a strategy to a behavior as well as user groups and peculiarities of the situation at play. Also, there were ten (10) selected strategies for personal gamification tailoring (Orji et. al., 2014)

From available literature, one of the earliest identified persuasive strategies is Caldini's Six (6) Principles. They were identified by multiple literature reviews on persuasive strategies. Various health interventions have explored a variety of them to varying degrees of success. Other persuasive strategies identified in review studies include those found in Fogg's Health Belief Model (Fogg, 2009), Persuasive Design Systems - PDS (Oinas-Kukkonen & Harjumaa, 2009) and the Trans - theoretical Model - TTM (Prochaska & Velicer, 1997). For this purpose of this study to identify the elements of persuasive strategies used in mHealth apps for stress management apps, the identified articles are categorized as presented in Table 3.1.

Table 3.1: Some Persuasion Technology (PT) Models and the Elements of Persuasive Strategies they Support

Six Principles of Cialdini (Cialdini, 2001)	Fogg Behavior Model (Fogg, 2009)	Persuasive System Design (Oinas - Kukkonen & Harjumaa, 2009)	The Transtheoretical Model - TTM) (Prochaska & Velicer, 1997)	Behavior Change Support Systems - BCSS (Oinas- Kukkonen, 2009)
(i) Commitment and Consistency. (ii) Authority (iii) Reciprocity - Rewards (iv) Liking (v) Scarcity (vi) Societal /Social	Ability {Simplicity:- (i) Time. (ii)Money. (iii)Physical Effort. (iv)Brain Cycles. (v)Social Deviance. (vi)Non-routine}	Task. Dialogue. System. Credibility. Social Support	(i)Pre- Contemplation. (ii) Contemplation. (iii) Preparation, or Determination. (iv) Action. (v) Maintenance. (vi)Termination: Individuals	(i)An interactive Picture (Interface). (ii)Consistent. (iii)Goal Setting. (iv)Monitoring (v)Social Interaction. (vi)Human- Computer

					Interaction.
Attestation	Motivation Trigger				(vii)Tunneling.
					(viii)Reduction.
					(ix)Self-Monitoring.

The following Table 3.2 presents the grouping of studies by the types of behaviors they analyzed, summary of settings, population and study designs for each group, the measures and the findings.

Table 3.2: List of Persuasive Elements and Contexts of Use in mHealth Apps for Stress Management.

S/N	Author	Article Type	Population	Persuasive Element	Context for Behavioral Change
1	(Hoffmann et al., 2017)	Expert Review.	Young people & the Middle Aged.	- Gamification. - Digital Rewards. - Real World Prizes. - Social (Avatar, Agent, Competition Teams). - Parallel Communication Systems - Social Pressure. - Feedback, Levels, Secondary Game Objectives. - Ranks of Achievement. - Leaderboards. - Time Pressure.	Mental Health apps.

				- Environment. - Narrative Context. - 3-D Environments.	
2	(Lane et al., 2014)	Full Article	Multidimensional or Diverse Group	Feedback, Social Interactions, Scores, Physical Activity, Ambient Display, Community.	Well being.
3	(Arshad et al., 2019)	Empirical review	Young Adults.	Tailoring, Support Based User Feedback, Social Networking, Self-Tracking, Positive And Negative Reinforcement, Incentivize, Commitment, Mindfulness.	Smoking Cessation.
4	(Gorini et al., 2020, p109)	Book Chapter	General Population.	Informing, Reinforcement, Discussing, Social Interaction, Fear Appeal, Skill Training.	Patient Wellbeing and Engagement.
5	(Simons, Foerster, Bruck, Motiwalla, & Jonker, 2015)	Full Article	Ageing Workforce.	Micro Learning Health Quiz, Personal Health Activities, Weekly Health Tip Mail, Start Survey, Feel Better (Emotion), Do It As Group (Cooperative), Buddy.	Different Health Behavior.
6	(Sharon, 2017)	Full Article	General Population.	Personalized & Self-Tracking, Autonomy, Authenticity, Solidarity.	Well being.

7	(Perski, Blandford, West, & Michie, 2017)	Systematic Review	General Population.	Tailoring, Self-Tracking, Gaming, Novelty, Interactive, Message Tone, Reminders, Reinforcement, Social Support, Recognition.	Mental Health, Motivation, Expectation.
8	(Gravenhorst et al., 2015)	An Overview	General and Clinicians, Caretakers.	Self-Reporting, Location, Physical Activity, SMS. Reminders, Phone Engagement, Voice Analysis, Interaction/ Feedback.	Mental Disorder.
9	(Morley & Floridi, 2019)	Article	Young adults	Gaining Knowledge, Awareness, Self-Reflection, Action, Digital Companion, Self-Management, Personalization, Autonomy.	Patients' Empowerment, Cystic Fibrosis.
10	(Aryana et al., 2019)	Exploratory Review	Adolescent and Old Adults.	Individualized Therapy, Sensing, Self-Track, Engagement, Daily Action.	Mental Health.
11	(Gould et al., 2019)	Systematic Review	Young Adults and their Family Members.	Self-Management, Self-Tracking, Cognitive, Relaxation, Engagement, Adherence, Motivation, Compliance, Customization, State of Emotions, Games for Distraction.	Student Population.

12	(Orji & Moffatt, 2018)	Systematic Review	General Population Grouped into Categories.	Tracking and Monitoring, Social Support, Sharing and Comparison, Competition, Leaderboard, Ranking, Rewards, Points, Goal and Objective, Audio Visual and Textual Feedback, Persuasive Messages, Reminders, Virtual Rehearsals and Simulation, Positive and Negative Reinforcement, Suggestions, Praise.	Health and wellness.
13	(Qasim et al., 2018)	A critical Review.	Healthcare, General Population.	Simplicity, Fulfillment, Perfection, Earned Credibility, Reputed Credibility, Surface Credibility, Reciprocity, Real-World Contexts, Convenience, Personalization, Praise, Attractiveness, Surveillance, Normative Influence, Authority, Similarity, Symbolic, Virtual Rehearsal, Social Facilitation, Cause And Effect, Social Comparison, Kairos, Suggestion, Conditioning, Tailoring, Tunneling, Social Learning , Recognition, Cooperation, Expertise, Sensory, Marriage,	Healthcare, Personal Care

				Trustworthiness, Self-Monitoring, Competition	
14	(Arshad et al., 2019)	Conference Article	General Public or Individuals.	Exercise, Frequency, Duration or Intensity, Prompts, Reminders, Personalization, Emotional (Emoji), Interfaces, Persuasive Prompts	Depression and Wellness.
15	(Owen et al., 2020)	Full Article	Veterans and their Families	Self-Efficacy, Measures of Self-Efficacy Combination Coping , Self-Monitoring.	US Military PSTD.
16	(Borjalilu et al., 2019)	Full Article		Multimedia – Visual, Audio Content was on Mindfulness Skills in Meditation, Notifications Movement, Self-Monitor Emotions - Kindness Practice, And Maintaining A Regular Practice. Audio Messages- Related to Single, Specific Sounds (Environment), e.g., the Sound of Nature such as Waterfalls, River Flow, and the Wind and Bird Songs.	
17	(Zakaria et al., 2019)	Conference Article	Pregnant Women	Personalization	Monitor Stress and Depression in Maternity

				Physical Social - Interactions Team Or Workgroups. Peer And Classmates, Social Media Influence.	
18	(Boateng & Kotz, 2018)	Conference Article	General Public	Time-Based Features, Continuous Measure and Monitor the Stress Levels of Individuals as Scale of Low, Medium, and High. The Stressaware App was developed for the Amulet Wearable Device. Heart-Rate Monitor (Self-Tracking) Logs that have Information and Interface, Scientific.	General Well Being.
19	(Ahtinen et al., 2013)	Conference Article	Working Class	Mindfulness Awareness Interface Credibility Information Tunneling and Reduction	Stress Management among University Employees.
21	(Drissi et al., 2019)	Conference Article	General public	Gamification, Entertainment Emotional Regulation, Stress Release Interaction or Social Support. An Example of this	PSTD Management.

				Type of Games: Puzzle Games. Biofeedback-Based Games, Goals, Achievements, Levels, and Points, to Better Engage and Motivate the User.	
22	(Barroso et al., 2020)	Journal Article	HIV/AIDS Patients	Self-Report Measure. Credibility/Expectancy. Favorable Beliefs. Participation Scale. Consistency. Convergent Validity.	Public Health.
23	(Sanches et al., 2010)	Conference Article	General Public.	Interface. Adaptability. Jagged in shape. Emotional Interaction.	Everyday Day Use, Wellness.
24	(Bakker et al., 2012)	Full Paper	Corporate Employees.	Stress Detection And Expectation And Coaching. Models and Coaching in the Domain Expect Scientific Credibility, Physical and Emotional Awareness and Self-Tracking Stress Levels.	Workplace.

25	(Kelley et al., 2017)	Conference Paper	University Students and Staff.	Communication, Social Interaction.	University Students and Staff.
26	(Yu et al., 2017)	Conference Article	General Public.	Simulations Or Role Playing Like Guides, Emotions, Interface,Simplicity, Feedback, Gamification.	Wellness or Chronic Stress.
27	(Cvetković et al., 2017)	Conference Article	General Population	Participative or Teamwork or Cooperative, Interface For User's Engagement. Goal Setting. Information. Recommendations. Leaderboard or Score.	Wellness, Sedentary Lifestyle, Physical Activities.
28	(Ptakauskaite et al., 2018)	Conference Paper	General Population	Prompts to Reflect. Providing Guidance (Advice Or Recommendation). On When and Why. Explicitly Instructs. Mindfulness. Awareness. Guidance on Reflection. Information.	Healthcare, Patient Care Support

				Social Support.	
				Interface, Visualizations .	
				Suggestion.	
				Meditation (Reflection).	
				Self-Tracking.	
				Supporting Action.	
				Goal Setting, Planning, and Using Reminders Supported Action.	
29	(Sykianaki et al., 2019)	Conference Article	General Population	Relaxation Program Expectations Stressed, The Offered Relaxation Program In Two Sessions, A Mono-Sensory and a Multisensory One, Simulation The Relaxation - Music The Sense - Environment Smell - Experiences	Home
30	(Devincenzi et al., 2017)	Conference Article	PSTD	Information; Ability and Motivation Positive and Negative Reinforcement of Behavior	US Dept. Veterans

				Monitoring; Selection and Relationship Quality.	
31	(Paredes Et Al., 2014)	Journal Article	US Veterans	Endorsed as Psycho - Education on Information. Helpfulness of the Practical Tools to Self-Manage, Advice, Ratings, Self-Management	PSTD

3.7. CONTEXT FOR BEHAVIORAL CHANGE OF PERSUASIVE ELEMENTS

The current literature exhibited widely diverse applications of persuasive elements in different settings. Table 3.2 presented the varying combinations of elements of persuasive elements to achieve different types of behavior change when addressing stress in users. There was significant use of mHealth apps for stress management for PSTD veterans as shown in (Drissi et al., 2019; Devincenzi et al., 2017 ; Paredes et al., 2014). Out of those who targeted the young population and universities environment, self-tracking, action, interface, emotions and personalization were among the dominant elements present in the studies (Kelley et al., 2017; Arshad et al., 2019 ;Tamim & Grant, 2016). The diversity shown clearly suggested the variation in the type of persuasive elements effective for different demographics.

Healthcare workers in areas where mental health still has stigma found the use of mHealth apps an effective way of accessing the care needed as well as change in the lifestyle that helped address the distress or depression. However, evaluating the level of stress in patients is still questionable, as different approaches were adopted in different studies and implementations of applications.

The use of physiological or psychological means both came with its challenges. While patients or users wanted a non-intrusive method of measuring their stress levels, most studies used convenient ways to evaluate the state of mental health of a patient or user; especially as most users found it easier to use the apps at home (Ahtinen et al., 2013). It therefore strongly depended on users who also found the use of mobile phone convenient.

3.7.1 ELEMENTS OF PERSUASIVE STRATEGIES IN EXISTING MOBILE APPS FOR STRESS MANAGEMENT

Existing mHealth apps in healthcare showed most of the apps reviewed or reported in these papers were exploratory or research based. Limited number reported on commercially available mobile apps for stress management (Owen et al., 2020; Drissi et al., 2019). Commercially available apps require payments; hence they may be out of the reach of the population in dire need of them. Healthcare workers have implemented some of them with promising reports (Qasim et al., 2018).

Gamification, self-tracking, information and rewards are among the favorite elements that mHealth apps designers attempt to implement. However an expert review concluded that Gamification was not used solely in behavior change but combined with other techniques with evidence base for stress management (Hoffmann et al., 2017). There are limited apps or devices that combine multiple persuasive strategies to achieve behavioral change for stress management (Sanches et al., 2010).

3.7.2 ELEMENT OF PERSUASIVE STRATEGIES FOR UNIVERSITY STUDENTS

Tamim & Grant(2016) posit that feedback and motivation were the elements of persuasive strategies implemented in an educational setting. The four (4) persuasive strategies highlighted are instruction, social feedback, motivation or reward type and reinforcement types. There is also self-tracking (Arshad et al., 2019; Aryana et al., 2019). There have been wide studies on persuasive technology in health, especially in the mental health domain as well as the different persuasive technology models and theories. All the models adopt different approaches to achieving some level of measurement.

Popular domain reviewed literature included health promotion and prevention. There was a couple of literature on high school students, especially female students with social interaction induced stress, medical students exposed to stress as a result of academic workload and university students who experienced distress because of multiple factors of academic pressure, relationship, distance to loved ones and new environment (Gould et al., 2019; Kelley et al., 2017).

Existing literature provided a plethora of elements of persuasive strategies across different healthcare domains targeting behavioral health changes among diverse populations as discussed in the introduction. Typically, a persuasive technology study or intervention will include a model or theory such as Fogg's Health Belief Model, Persuasive Design Goal theory Model, Transtheoretical Model, Self-determination

Model, Social Cognitive Theory, Social Conformity Theory, etc. Significantly identified in many kinds of literature are Cialdini's six (6) principles of persuasion. All the models or theories utilized different approaches or strategies to achieve some form of behavioral change.

In the different articles reviewed, there was social support, persuasive text messages, tracking and monitoring, sharing achievement, authority, commitment and consensus, empathetic expressions, feedback (Barroso et al., 2020), gamification (Yu et al., 2017; Drissi et al., 2019), awareness (Kelley et al., 2017), mindfulness (Hwang & Jo, 2019), positive and negative reinforcement, source credibility - expertise and trust, social influence, reminder, competition, collaborations, tailoring & personalization, consistency, praise (Bakker et al., 2012), social cues, cooperation & collaboration and social support.

Caldini's six (6) principles (reciprocity, scarcity, authority, consistency, liking and consensus) found expression in one form or the other. The different elements are similar in practice. Many of the mobile apps for stress management used self-tracking and monitoring (Boateng & Kotz, 2018). Self-management functions, competition and rewards were also widely used in several especially those involved in gaming or leaderboard based interventions (Thomson et al., 2016; Gould et al., 2019).

There were different levels of successes achieved on the elements of persuasive strategies employed and the demographics involved. An early clear indicator was the importance of social interactions, reward or points on a leaderboard and sharing among peers for studies and interventions involving young adults. Anonymity was also in high demand. Tailoring and customization were also frequently used because of the high uptake of these features.

Some studies found that subjects that had the ability to achieve mindfulness, self-monitoring and tracking, as well as self-management, recorded some level of behavioral change, improved lifestyle, awareness and involvement in their health condition. They also experienced Improved engagement with caregivers or counselors (Paredes et al., 2014). Multiple authors also recognized the downside of employing persuasive elements for mental health management to include influence or biases and misconceptions that could lead patients to making disadvantageous or poor choices (van der Meer et al., 2020). Some identified poor adoption of included elements or mHealth apps. Across all literature there was a lingering concern for privacy and patients' data (Kelley et al., 2017; Drissi et al., 2019).

Customization and tailoring were cumbersome if large coverage was to be undertaken. The studies showed the need for unique adjustment for individuals' taste (Orji & Moffatt, 2016). Low adoption and

limited data use were also highlighted. Periods of studies were often short as against long term behavior change required by subjects.

Multiple levels of behavior changes were reported in existing literature; from becoming aware of their stress condition to the mindfulness of existing stress levels. Persuasive strategies implemented in mHealth applications have enabled mental health patients to seek help and encouraged discussion of their health situation (Hwang & Jo, 2019). It has been suggested by multiple sources that the ability to self-track and monitor provides patients with opportunities to manage their stress conditions thereby preventing chronic conditions or depression (Kelley et al., 2017).

The apps helped bring about convenient ways to evaluate the state of a patient or user's mental health especially since most users found it easier to use the apps at home (Ahtinen et al., 2013). Since the users considered the use of mobile phone convenient, it aided the evaluation since that largely depended on users' responses.

3.7.3 SUMMARY OF ELEMENT OF PERSUASIVE STRATEGIES AND THEIR DESCRIPTIONS.

Different articles or studies adopt different lists of components or elements of persuasive strategies as deemed suitable. There is no universally accepted and exhaustive list of persuasive strategies. The studies in the literature adopted similar elements of persuasive strategies (Orji & Moffatt, 2018), (Ferebee, 2010) and (Qasim et al., 2018).

Table 3.3. presents some of the elements. There is a need for a globally acceptable standard list of elements of persuasive strategies.

Table 3.3 Elements of Persuasive Strategies and their Descriptions.

	Elements of Persuasive Strategies	Description	References
1	**Awareness**	It is creating user awareness of their behavior in order to facilitate change.	(Fogg, 2009)
1	**Personalization**	Offer personalized contents and services to users. Contents are tailored to suit a user's need.	(Arshad et al., 2019)

2	**Mindfulness**	It is paying attention in a particular way: on purpose, in the present moment, and non-judgmentally.	(Kabat-Zinn et al., 1998)
3	**Reminder/ Tunneling**	Lead users through redefined steps for accomplishing the target behavior and guide them from distracting actions.	(Ahtinen et al., 2013)
4	**Self-tracking /Self-monitoring**	Allow people to monitor themselves to inform them about how they might modify their attitudes or behaviors to achieve a desired goal or outcome.	(Gould et al., 2019)
5	**Social Competition**	Provide means for a user to compete with others.	(Orji & Moffatt, 2018)
6	**Anonymity**	The opportunity to provide privacy or be faceless.	(Kimura & Nakajima, & 2011)
7	**Reward/Positive reinforcement**	Offers virtual rewards to users for performing the target behavior.	(Perski et al., 2017) (Orji & Moffatt, 2018)
8	**Scarcity**	Apparent shortage will bring about demand.	(Cialdini, 2001)
9	**Goal Setting**	Allow users to set behavioral goals.	(Consolvo et al., 2009)
10	**Monitoring**	Allow one party to monitor behavior of another party.	(Zakaria et al., 2019)
11	**Social Role**	Social encouragement, feedback, etc.	(Orji & Moffatt, 2018)
12	**LeaderBoard Gaming**	Lead users through predefined steps for accomplishing the target behavior and guide them from distracting actions.	(Hoffmann et al., 2017)

13	**Cooperation**	Requires users to cooperate (work together) to achieve a shared objective.	(Borjalilu et al., 2019)
14	**Environment**	The impact of the context in which user is present.	(Tamim & Grant, 2016) (Zakaria et al., 2019)
15	**Interactive/ Interface**	A computing technology that is visually attractive to target users is likely to be more persuasive as well.	(Orji & Moffatt, 2018)
16	**Periodic/Time**	Ability to select various time intervals for any of the preferred activity types.	(Thomson et al., 2016) (Boateng & Kotz, 2018)
17	**Authority /Credibility Persuasive Communication**	Credible source presents arguments in favor of the behavior.	(Qasim et al., 2018)
18	**Liking**	People are more likely to be easily persuaded by other people they like.	(Cialdini, 2001)
19	**Expectation / Commitment and Consistency**	If individuals have decided to implement a goal or commitment, they are likely to pledge their commitment to the idea or objective as being like their personality. Even if the initial motive is removed, individuals are likely to continue with this obligation.	(Rozenbojm et., 2015) (Cialdini, 2001) (Barroso et al., 2020)
20	**Self-monitoring / Emotion**	Affordance, Playfulness, Emotions, humor, for Emotions	(Vainio, & Kaipainen, 2014)
21	**Reward/Positive Reinforcement Negative Reinforcement**	Offers virtual rewards to users for performing the target behavior.	(Adaji et al., 2018).

CHAPTER FOUR

RESULTS AND ANALYSIS: STRUCTURED INTERVIEWS

4.1. INTRODUCTION

Chapter 3 marked the completion of Phase 1 of this study which entailed identifying elements of persuasive strategies in existing literature, and the ones applicable to university students. The findings provided relevant information that led to the development of elements of persuasive strategies for this study.

This chapter focuses on Phase 2 of the study, which highlights the development of the recommended guidelines of persuasive strategies for mHealth apps for stress management among NUST students. Furthermore, the chapter addresses the sub-questions presented in chapter one (section 1.4):

- **What are the elements of persuasive strategies to facilitate the use of mobile applications relevant to support stress management among university students in Namibia, as determined by NUST students?**

- **What guidelines or recommendations are required to be incorporated in the development of mHealth applications for stress management to facilitate use by university students in Namibia?**
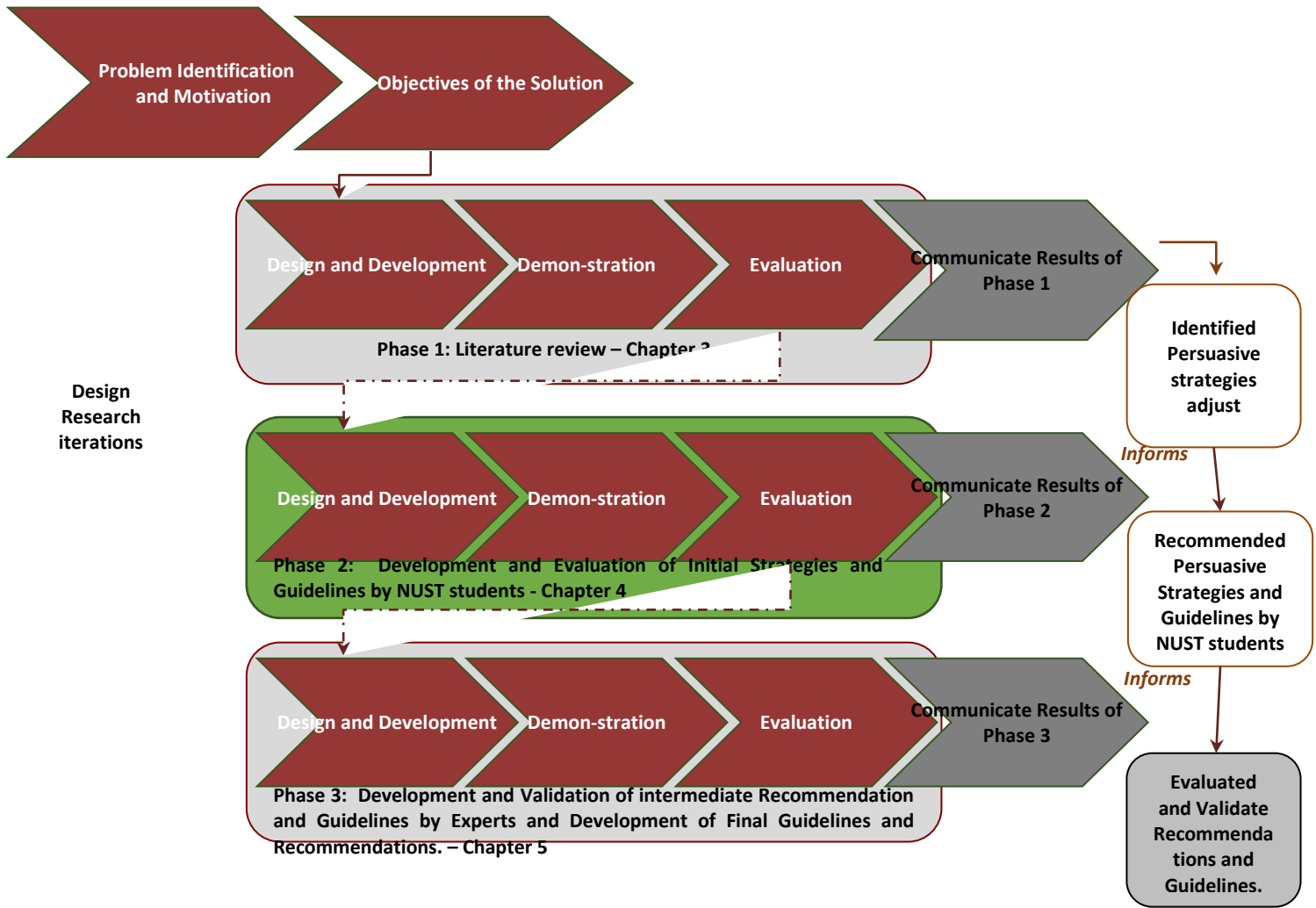
Figure 4.1 DSR iteration Showing the Green Highlighted Segment.

This chapter also addresses the research sub-objectives highlighted in chapter one (section 1.5):

- **To investigate the elements of persuasive strategies to facilitate the use of mHealth applications relevant to support stress management among university students in Namibia, as determined by NUST students.**

- **To develop guidelines and recommendations capable of persuading students to use mHealth for stress management and instructional to developers and designers of mHealth app for stress management**.

Figure 4.1 highlights the phase being discussed in Chapter 4 (encircled in green). The findings from this chapter form the basis of the discussions in Chapter 5. The next section describes the research instrument.

4.2. THE RESEARCH INSTRUMENT

In order to answer the research questions and objectives presented in chapter one (section 1.4), structured interviews were applied for primary data collection (Appendix 2). The size of the sample was guided by interpretivism philosophy (Dudovskiy, 2018) which is popular with small sample sizes, in-depth investigations and qualitative studies. The sample size was limited to fourteen (14) and stopped when it became evident that the researcher was experiencing repetitive data from the interviewees. So saturation was reached when new participants were no longer adding new information to the research (Saunders et al., 2019).

The next section presents information on the structured interviews

4.2.1. STRUCTURED INTERVIEWS

The researcher conducted individual interview sessions with each participant. Fourteen (14) students participated in the interviews. Each participant chose a convenient time and place for the conduct of the interview. Each interview lasted approximately thirty-five (35) minutes. Each interview had the same set of questions.

Table 4.1 presents the list of interview questions with each element of persuasive strategy (section 3.6.5).

Table 4.1: Structured Interviews.

Semi-Structured Interviews	Question Number	Question (Persuasive Element)	Objectives
	1A	**(Awareness)**	The objective of this question was to investigate the level of the student's consciousness of their mental health status or stress they experience such that it facilitates a change in behavior.
	1	Do you own a smartphone? If so, how often do you use your smartphone for stress management? **(Personalization)**	The objective of this question was to know whether personalized contents and services to a student's need will motivate his or her use of mHealth apps.
	2	How will regular reminders on your phone encourage you to be mindful of your stress condition? **(Mindfulness)**	The objective of this question was to find out whether a persuasive element that calls the student's attention to their particular present moment and that is non-judgmental will motivate the student to use the mHealth app.
	3	Would reminders be relevant to facilitate the use of mHealth apps for mental health? Why? **(Reminder) (Tunneling)**	The objective of this question was to know whether the element that leads users through predefined steps for accomplishing the target behaviour and guides them from distracting actions will be relevant.
	4	How will self-tracking help you manage your stress? **(self-tracking)(Self-monitoring)**	The objective of this question was to know whether allowing students to monitor themselves to inform them about how they might modify their attitudes or behaviours to achieve a desired goal or outcome will be relevant to their use of mHealth apps for stress management.
	5	What will be the appropriate level of competition and incentives will you be willing to engage in the process of managing your stressful conditions? **(Social competition)**	The objective of this question was to know whether providing means for a user to compete with others will facilitate their use of mHealth apps for stress management.
	6	When sharing your mental health status anonymously, to which extent are you encouraged to share? And why? (**Anonymity)**	The objective of this question was to know whether the opportunity to be faceless or secret or anonymous will facilitate the use of mHealth apps for stress management
	7	How does getting rewards for using mHealth apps for stress management affect your use of it? **(Reward/positive reinforcement)**	The objective of this question was to know whether offering virtual rewards to users for performing the target behaviour on an app will be relevant or motivate the use of mHealth apps for stress management.

	8	How much will you be willing to pay to be among the few students using mHealth apps for stress management? And how likely are you to sign up for it? **(Scarcity)**	The objective of this question was to know whether apparent shortage will bring about demand to use mHealth apps for stress management.
	9	In what ways will goal setting change the ways you use mHealth apps to manage stress? **(Goal setting)**	The objective of this question was to know whether allowing users to set behavioural or stress level goals will motivate the use of mHealth apps for stress management.
	10	How would you respond to an accountability partner facilitating the use of mHealth apps for stress management? **(Monitoring)**	The objective of this question was to know whether allowing one party to monitor the behaviour of another party will motivate the use of mHealth apps for stress management.
	11	What is the effect of having your peers or classmates motivating you to use mHealth apps for stress management? **(Social Role)**	The objective of this question was to know whether social encouragement, feedback, etc. will motivate NUST students to use mHealth apps for stress management.
	12	How does earning points on a leader board impact your use of a mHealth apps for health conditions improvement? **(LeaderBoard)(Gaming)**	The objective of this question was to know whether the use of Gamification, that is, the use of game elements in non-game contexts, is aimed at making interventions (including mobile apps for behavior change) more enjoyable, motivating, and engaging relevant to the use of mHealth apps for stress management.
	13	In what ways would participating in a team effort to address mental health with mHealth apps among students encourage or discourage your participation? **(Cooperation)**	The objective of this question was to know whether requiring the users to cooperate (work together) to achieve a shared objective is relevant for NUST student to use mHealth apps for stress management.
	14	How does your environment influence the use of mHealth apps for stress management? **(Environment)**	The objective of this question was to know whether the impact of the context in which a user is present is relevant to the use of mHealth apps for stress management.
	15	In what ways does the interface of a mHealth app for mental health motivate you to use it for managing your stressful conditions? **(Interactive)**	The objective of this question was to know whether a computing technology that is visually attractive to target users is likely to be more persuasive to facilitate the use of mHealth apps for stress management.
	16	How does the time-based or periodic schedule engagement of mHealth apps work for you? **(Periodic)**	The objective of this question was to know whether the ability to select various time intervals for any of the preferred activity types will facilitate the use of mHealth apps for stress management.

	17	How motivated are you to use mHealth apps for stress management if it gives a valid scientific argument or facts about its effectiveness? **(Authority) (Credibility)(Persuasive Communication)**	The objective of this question was to know whether a credible source of information presents good arguments in favour of the use of mHealth apps for stress management.
	18	How motivated are you to use a mHealth app for stress management if you find the profile of the person on the app fits yours? **(Liking)**	The objective of this question was to know whether students are more likely to be easily persuaded by other people they like to motivate the use of mHealth apps for stress management.
	19	What level of impact will the expectations set on an app affect your decision to use or not use it? **(Expectation) (Commitment and Consistency)**	If individuals have decided to implement a goal or commitment, they are likely to pledge their commitment to the idea or objective as being like their personality. Even if the initial motive is removed, individuals are likely to continue with this obligation.
	20	How will mHealth apps for stress management with emotional features like humor, joy and sadness faces encourage your use of it**? (Self-monitoring) (emotion)**	The objective of this question was to know whether Affordance, Playfulness, Emotions, Humour or Sorry to depict the feelings of the user will motivate the use of mHealth apps for stress management.
	21	How does positive or negative enforcement of your behaviour by mHealth apps for stress management encourage your use of it for your stress conditions? **(Reward/Positive Reinforcement Negative Reinforcement)**	The objective of this question was to know whether offers of virtual rewards to users for performing the target behavior will be relevant to the use of mHealth apps for stress management.
	22	What do you think of mHealth apps for stress management that give you recommendations, suggestions or advice to motivate your use? **(Suggestions and Kairos)**	The objective of this question was to know whether suggestions of certain behaviors (for achieving favorable outcome) to the users during the system use are relevant to the use of mHealth apps for stress management.
	23	Please how will you use mHealth apps for stress management that engage you in some simulation or role-playing activities? (**Simulations) (Role-playing)**	The objective of this question was to know whether allowing users to perform behaviour in simulated situations will motivate them to use mHealth apps for stress management.

4.2.2. TRANSCRIPTION, CODING AND ANALYSIS PROCEDURES

The interview sessions were recorded, saved for listening and transcribed verbatim. Notes were taken from the recordings and only portions of the participants' views and meanings were documented (SAGE Publications, 2017). The consent of the interviewees was sought and confirmed in advance.
The next section provides information on the participants.

4.2.3. THE RESEARCH PARTICIPANTS

The recruitment of research participants was based on a basic set of requirements. Since the research is a case study of NUST students, interviewees were compulsorily students of the Windhoek campus who were students of the institution for up to at least a year. Qualified candidates were selected arbitrarily once they met the primary requirements.

Table 4.2 provides background information of the participants of the study.

Table 4.2 Research Participants.

Participant	Gender	Year of Study
1	Female	Two
2	Female	Two
3	Female	Three
4	Male	Two
5	Male	Three
6	Male	Two
7	Male	Three
8	Female	Three
9	Female	Two
10	Female	Three
11	Female	Two
12	Male	Two
13	Male	Three

	14	Male	Masters

4.2.4. STUDY LOCATION

The Namibia University of Science and Technology (NUST), the University of Namibia (UNAM) and the International University of Management (IUM) are the major universities in Namibia. They are all situated in the Khomas region. The region ranks one of the top four regions with the highest suicide rates in Namibia (Kangootui, 2016). Urban centers tend to account for more stressful situations for university students (Coyle & Vera, 2013). The Ministry of Health and Social Services (MOHSS, 2018) National Study on the prevalence of and interventions in relation to suicide in Namibia, indicates ages 20-30 years (coincidentally the age range of most of the university student population) as the highest number of people with attempted suicides rates; especially educated and living in urban settings such as the Khomas region. Windhoek is the capital is city of Namibia. The university has a student population of about 10,500. The next section presents the findings of the study.

4.2.5. FINDINGS

The findings of the structured interview are presented in Table 4.3.

Table 4.3 Findings from Students in NUST.

	PART A	Interviews Responses
1A	Are you aware of any management tools for stressfulness? If yes, please elaborate **(Awareness)**	Participant 1: "*No*" Participant 2: "*None*" **Participant 3**: "Yes *I listen to music when I'm stressed. I listen to music and drink warm water. Sometimes, I cry.*" **Participant 4**: *"Yes. When am stressed, I usually use my phone to listen to music, watch some funny YouTube videos and anything that can help me in relieving my stress. I also watch football because I am a fan. '* **Participant 5**: *"Yes, I just find the time to overcome what is pressuring me. Maybe its assignment, I just finish it."* **Participant 6**: *"Yes, I only know of exercising and doing what you love most."* **Participant 8**: "*Yes, just do your assignment on time to avoid stress and listen to music. It will calm you down and do anything that makes you happy.*"

		Participant 9: "*I do know but I have seen people use it. If a person is into sports, they drop everything and they go do that just to free their minds.*"
		Participant 10: "*No, I really don't know*"
		Participant 11: "*Yes, I am aware. We are different people. We do things differently. For me, I would like to come home, listen to music and just sleep or if not, I'll like to talk to someone about it. The other way is that, I'll like to eat. Sleeping helps because you don't think about the issue and you're fine. When you talk to someone about it, you are taking that stress off you, and when you eat, it makes you confident. When I listen to music, it must be very loud, because it is relaxing.*"
		Participant 12: "*Yes I know. If I am stressed, I exercise. Let me say I do some gyming, and when you are stressed, and you are doing something, you might forget about being stressed.*"
		Participant 13: "*I am not aware of any stress management tools, but sometimes I just chat with friends or use social media platforms to help reduce the stress.*"
		Participant 14: "*No I am not aware.*"
	PART B	**PERSUASIVE ELEMENT & MHEALTH APPS**
1	Do you own a smartphone? If so, how often do you use your smartphone for stress management? **(Personalization)**	**Participant 1**: "*Yes, definitely, I can say I do. My phone has been so helpful. I have a book app. So when I am stressed, I tend to read the book and listen to music at the same time.*"
		Participant 2: "Y*es, I do have a smartphone and yes I use it when I might be feeling a little bit uncomfortable. I take my phone and text my friends and have a little chat and I will be fine. I don't really listen to music because I feel like music makes me emotional sometimes. So I prefer talking to people.*"
		Participant 3: "*Yes, I own a smartphone. That is where I get music to manage my stress. So I listen to music.*"
		Participant 4: "*Yes, I do. Yes, I use it to manage stress.*"
		Participant 5*: "Yes, when I wake up, I press my phone to listen to specific music. If I listen to it fully, I go and bathe. If I have a test, I check for funny videos, my mind relaxes, then I'm good to go to the test.*"
		Participant 6: "Y*es, I own a smartphone. No, I do not use it for stress management.*"
		Participant 7: "*Yes, I watch African movies.*"

		Participant 8: *"Yes I own a smartphone. I use it sometimes but not always for stress management."*
		Participant 9: *"Yes, I listen to music and I have multiple game apps on social media which have funny stuff."*
		Participant 10: *"Yes, I have a smartphone. No, I don't use my smartphone to manage stress. How can you use your phone to manage stress?"*
		Participant 11: *"Yes, I own a smartphone, if I'm stressed, I'll like an app, but what I do most times is listen to music on my phone, lie down and think."*
		Participant 12: *"Yes I do have a smartphone. Yes I use it when I am stressed. I watch something that can boost my energy like watching comedy. It can make me forget about the stress a bit."*
		Participant 13: *"Yes, I own a smartphone. Yes I use it sometimes especially when I access social media, or I listen to music."*
		Participant 14: *"Yes I do have a smartphone. Yes I do use it for stress management. I just have to watch something that takes my mind off my work that is distracting me."*
2	How will regular reminders on your phone encourage you to be mindful of your stress conditions? **(Mindfulness)**	**Participant 1**: *"Not at all. Well, not for me but I will encourage it for other people."*
		Participant 2: *"Yes, I will because an app will help me in a lot of ways. Number one, time management and number two, it will remind me that I have not done this or the reason why this is happening is because you did not do this; you need it because it's like you have a friend that is there to remind you that you did not do this."*
		Participant 3: *"Yes, because it makes you aware that now you are about to be stressed and sometimes you get stressed and you won't be aware for certain period of time; but the app that will really tell you that you're stressed. At least you can know how to come about managing it."*
		Participant 4: *"You cannot prevent some things. Somebody like me, I have a strategy just to avoid stressing myself. I get to understand the situation. If I am stressed because I failed a test, there is nothing I can do about that paper that I wrote and failed. In order for me to improve or be ready for the next test, I just have to accept and understand that yes I failed it; let me just keep it like that and hope for the next one. I will manage to pass . I don't usually give myself limits so if it's an app that I have to use to reduce stress, I will not limit myself not to use it."*

		Participant 5: *"Yes, one day you'll be used to it. When this phone is ringing, I must wake up. It Is time."*
		Participant 6: *"Yes it helpful to remind me that I am going through stress at a certain time."*
		Participant 7: *"I don't know because I have never had that app. Maybe I will like the app but I'm not aware of such an app at the moment. But I know when I have stress and I know what to do when I have stress. I don't need something to tell me."*
		Participant 8: *"No. I will not like it because I will not want to be reminded about that stress anymore. I would also like it if it has to remind me that I am stressed at the moment and it will help me avoid it"*
		Participant 9: *"I think so; because stress is something that needs things like bible quotes and verses for the stress to come down."*
		Participant 10: *"It will definitely. It will help me, and it must tell me what to do."*
		Participant 11: *"It will be probably useful when you're reminded. Sometimes not, sometimes yes. When you're reminded by your phone when an assignment is due, and that you have to do this and that, that would overwhelm you with the pending activities and eventually stress you. If you are aware that you're stressed, you'll tell yourself, let me relax; let me do it this way, probably it will lead me to this, and it will help me solve this. So it can help in another way."*
		Participant 12: *"I will not like it because I do not want to be reminded that I am stressed".*
		Participant 13: *"I will like it because if there is something that can help me, I can use it to help myself."*
		Participant 14: *"I will be willing to use it. As I said earlier, it is about results. If it will help me get my results, why not go for it."*
3	Would reminders be relevant to facilitate the use of mHealth apps for mental health? Why? **(Reminder) (Tunneling)**	**Participant 1: "***Very much. It will be relevant because it's better to be mentally healthy than look physically well."* **Participant 2**: *"Yes I will definitely want it and use it for that again because it is reminding me about a lot of things that I am probably missing out or forgotten. You know, sometimes when you have a lot on your mind, you end up forgetting. So it would be definitely good reminding me that I have to do*

		this; that I should relax, stop stressing and stop doing work; that I have done enough."
		Participant 3: *"Nope. I can manage my own stress and I don't need the help of an app."*
		Participant 5: "*Yes, as soon as it reminds me of my pressure then I will put in efforts to kick away that pressure*."
		Participant 6: "*Yes, I would like to use such an app and it would be preventing me from drinking alcohol. It will be giving me another option*."
		Participant 7: "*I will not want that app because I know myself. Whatever is stressing me, if it's a person, I will tell that person straight away and that will resolve it*."
		Participant 8: "*Yes, it will because it will give me information on how to manage stress."*
		Participant 9: "*It will be annoying to me. I will not love it at all because I am a little bit naïve and I don't like hearing the truth sometimes. So telling me I have stress will make me more stressed."*
		Participant 10: *"I will like it. It will be telling me reasons why and what to do. It will become a problem when the app tells me not to work too hard or not to stress."*
		Participant 11: "*It will help me because if I would be reminded of what I have to do. It reminds you of things easily unlike when you have to remember those tasks. It will help when the reminder is in a logical manner and orderly, telling you the time to attend to tasks."*
		Participant 12: "*It will encourage me to use it because it is reminding me that I am having this stress. So I have to do this or that to reduce it."*
		Participant 13: "*I will use it because I would want to know so that I can solve it."*
		Participant 14: *"I will have a challenged mind because at the end I can also become stressed as well. I would prefer an app for a solution that will always be available when I need it on demand."*
4	Will self-tracking help you manage your stress? **(self-tracking)(Self-monitoring)**	**Participant 1**: "*I don't think so. I have seen that most people that get stressed regularly tend to become fitness freaks. They put all their efforts and time into being fit as a way to relieve stress but that is not how stress can be relieved.*

For one to be stressed something has to stress you out and for me I wouldn't want to keep going back to what stressed me out."

Participant 2: "*Yes I will be willing because it's needed. Again in case of me now when I am stressed, it will be telling me that I am stressing too much. This time, it would be a reminder that am pressuring myself too much to do things and then I will reduce it and do it another way.*"

Participant 3: "*Yes, because it reminds me of specific times and periods; so, during this specific activity, you get most stressed or maybe during this activity, you won't get stressed.*"

Participant 4: "*l am kind of an ignorant person. So l might have that app, but l might not use it regularly.*"

Participant 5: "*Obviously, it's like it is predicting what is going to happen. It will be like a warning that pressure is coming; move this way.*"

Participant 6: "*No it is time wasting.*"

Participant 7: "Y*es, I will appreciate that app. As long as I trust that app. Let's say today I'm really feeling like this and it says the exact same thing or almost the same thing, I will appreciate it.*"

Participant 8: "So *that I know how often I get stressed and what things I should do to be able to avoid the stress.*"

Participant 9*: "Yes, I would like that. l feel like if there is an app helping me without telling me I am stressed, it would be good and it would depend on how the app works.*"

Participant 10: "*It will, if I am the one enabling it to track me. It will be good if I can record the times that I'm stressed. It's good because it's like telling me I'm stressed, stop working. I tell it when I really need it and it can tell me what I need to do.*"

Participant 11: "*It helps because you are aware of the time you are happy. Later in the afternoon, you're sad. You'll be acquainted and familiar with your moods. So you'll be able to manage, calm down, feel your feeling and just manage it and not entertain pressure.*"

Participant 12: "*I will use it because it is helping me reduce my stress. It is much better to have something to help you solve your problem.*"

		Participant 13: "*I will be motivated to use the app because sometimes it is really hard for you to tell if you stressed or sick. For me, it is better to have an app to tell me that I am stressed. It feels better so that I can find a solution.*"
		Participant 14: "*I will still use it because that takes away the issue of reminders. I hope it will bring the issue of demand; that it will be able to track. I will definitely go for this approach.*"
5	What will be the appropriate level of competition and incentives you will be willing to engage in the process of managing your stressful conditions? **(Social Competition)**	**Participant 1**: "*None* " **Participant 2***: "It will definitely motivate and encourage me because most times when you don't want to use the app and you see another person using the app, you will want to use it too. Those competitors are encouraging me to like to do it."* **Participant 3***: "Highest level. I am willing to go for the highest. It tells me what makes me stressed, rather than just sitting and only getting to know that I'm stressed after three days. With the help of that app I will be able to know that maybe after playing soccer, I get stressed, and then I will stop playing soccer. I think yeah, because I want to win."* **Participant 4**: "*Yeah. It would because if it's in a game mode that will be great because it's also something that I do. I have things on my phone that if am stressed I just play the game. The problem with some games is that they are stressful. I would use it as long as it does not add to the stress.*" **Participant 5**: "*Yes, because, just waking up I will win; Even if I have to wake up before 7:30, because I know I will get something.*" **Participant 6***: "Yes because through competitions, you are changing every step of your life and you are finding out ways on how to lower your stress. And it matters because I would want to show that I am better.* " **Participant 7**: "*That will be discouraging. I just worry about myself and no other person. I don't care about outside sources, how they rate the app or whatever. I believe in me.*" **Participant 8***: "A competition of who uses it often."* **Participant 9***: "No. Such an app will make me angrier and depressed."* **Participant 10**: "*No. I will not use it because why will I compete with someone I don't have the same daily routine with? Competition does not appeal to me.*"

		Participant 11: *"Yes. Everyone wants to know how to manage stress. So if there is a competition that monitors who uses the app best, I would like to know how the winner uses the app to manage stress. I would also want to find new ways of using the app. I'll want to see how my peers use the app. The competition wouldn't make me use the app because the competition may make you lose all other purposes of using the app."* **Participant 12**: *"If that app is really used to help people, I will use it and if it is competitive, it is the best way to use it."* **Participant 13**: *"I will use it because seeing that there is competition, it will help reduce stress and it depends on the kind of the competition."* **Participant 14**: *"I will still use it because of the incentives. So it will be like killing two birds with one stone."*
6	When sharing your mental health status anonymously, to what extent will you be encouraged to share and why? (**Anonymity)**	**Participant 1**:*"Yes l would. For instance you grow up in a home where you are treated like an outsider; those thoughts will come to you and the thoughts will build u. Eventually you will get stressed. So it would actually help relieve that stress by telling other people your story, if they do not know you."* **Participant 2**: *"I will be willing to share because it is anonymous, and you will be getting motivations or answers from different people. It will feel good. I would like it to be anonymous because some people's responses to you will be negative and you don't want to feel bad."* **Participant 3**: *"I don't think I will do it; I don't think I will do it. I think I'm a very secretive person."* **Participant 4**: *"The problem with me is that I am a personal person. Even if I am stressed, l will not really go to someone and tell him or her that I am stressed about this. I will also try to help others by telling my story. Like when l was stressed, l did this and that and it helped me to reduce my stress. Some stories are shameful to tell. So, I prefer to be anonymous."* **Participant 5**: *"Yes, because no one would know it's you and someone might comfort you. You might have a big problem that no one knows, and you might be comforted and that might keep you going."* **Participant 6**: *"It depends on how people say I do things whether negatively or positively. If they are negative, I will stop and if the words are positive, I will keep up. Sometimes saying out the things that really hurt you makes you feel better."* **Participant 7**: *"Everything, so I can keep track of myself. Also because I know it's me, but they don't know it's me. So I can keep track of that. I can keep*

		sharing as long as they don't know. That way, they don't interfere with my affairs. They shouldn't know my identity." **Participant 8**: "*I will share more because I know they do not know me.*" **Participant 9**: "N*ot much because I feel like no one can do anything about it at the end of the day. If it's really eating me up, I would share but not that much.*" **Participant 10**: "*I will share as long as I'm not using my name because once I use my name, everybody will know my status, which is a very bad thing.*" **Participant 11***: "I am willing to share everything about my stress;, how it affects my daily activities because it is anonymous. I feel it will help others out there that feel like I'm feeling. I can also use that as a coping mechanism.*" **Participant 12**: "*It will not encourage me because if you are sharing your mental health, you are at the same time showing your weakness.*" **Participant 13**: "*I am more than willing to share regardless of if they know or if they do not know because there are some people out there who might have the same issue and they might be helped.*" **Participant 14**: "*I regard mental health as a private issue, and I wouldn't want to share it anyhow because it is personal. I also want to be sure of how secure the information is and how it is going to be used.*"
7	How does getting rewards for using mHealth apps for stress management affect your use of it? **(Reward/positive reinforcement)**	**Participant 1:** "W*hat is the point of me using an app if I am getting rewards? That would be like me selling out my stress.*" **Participant 2**: "Y*es I would use it and a reward is a good motivation and you will study hard to get a reward.*" **Participant 3**: "*I think it will motivate me more because I'm not only getting something out of it, it is tracking my stress and I'm also getting money.*" **Participant 4**: "T*hat might be addictive. I might end up concentrating and giving too much of my time to it and neglecting my schoolwork. Usually, if there is money you might end up concentrating on it.*" **Participant 5**: "*Yes, if I'm getting something and it's also managing my pressure. That is very good.*" **Participant 6**: "*It will encourage me to use it because I am getting something back from it and helping me to deal with my stress.*"

		Participant 7: "*Whether or not there is a reward, I will be honest with myself and keep track of myself. It is not about the reward. I'm not concerned about the reward. It's about me.*" **Participant 8**: "*It will encourage me because they offer benefits.*" **Participant 9**: "*I will use it because I am getting free stuff.*" **Participant 10**: "*It will motivate me if the reward is like money because I love money.*" **Participant 11**: I*t will motivate me; however, we are different. Reward would make you feel good. If I amusing an app and getting rewarded, I will feel good. But other people will be feeling like reward does not mean I'm coping with my stress. For me, I'll go for the app because of the stress and not the reward. Reward doesn't have impact. The point is, does it really help manage the stress?*" **Participant 12**: "*It will encourage me because I am getting a reward.*" **Participant 13**: "*I might end up using it for the sake of using an app and not for the stress management.*" **Participant 14**: "*I might end up using it for the sake of using an app and not for the stress management.*"
8	How much will you be willing to pay to be among the few students using mHealth apps for stress management? And how likely are you to sign up for it? **(Scarcity)**	**Participant 1**: "F*orgive me but no I will not sign up. You cannot be willing to buy someone's stress because it will be wrong to make someone pay for an app that helps keep track of their stress and helps you manage it as we know stress is something natural.*" **Participant 2**: "*I will not use it because if that app really wanted to help people, it would do it for free. So I believe I can get help from people like counselors. So I would not pay a single cent for it.*" **Participant 3**: "L*ike per month? Thirty (30) Namibian Dollars? Yes, I'll like to be part of those students because the app is nice and it helps me in a lot of ways. I don't think I get the question. I'm not going to pay for it and I'm not going to subscribe because everyone gets stressed and everyone has a way they manage their stress, and it's important for everyone to use that app. If they are not giving it to everybody, I'm not interested.*" **Participant 4**: "*if I can afford. If you are offering it does not matter the amount you offer. So whatever I can afford, I will just pay. It's not fair if it requires someone to pay. Then let everyone who needs to sign up to pay.*"

		Participant 5: *"I know how to handle the pressure that attacks me. I'm sure I won't be interested in signing up and paying when I can handle it without cost."*
		Participant 6: "*I will pay more than everybody so I can use it*".
		Participant 7: *"it depends on what I have in the bank. It depends on what I feel or what I have. If it's relevant to me, I might sacrifice the last 100 Namibian Dollars that I have. It will be determined by whether I like or not and not that I want to be exclusive."*
		Participant 8: *"Yes I will be willing to pay about 10 dollars a month."*
		Participant 9: "*it will really depend. If I am really that stressed then I will be willing to pay; not more than 10 Namibian dollars. It bothers me that it's a few students that are taken. How many will be left behind? However, if I can handle it myself, then I will let someone else go in my place.*"
		Participant 10: "N*o, why must I pay for an app when I can get one that will help me for free? I can get on Google play. No, I shouldn't pay."*
		Participant 11: "*It won't motivate me to use the app. Why do I have to pay? Maybe I will be tempted because only a few people are allowed to use the app. If it probably provides some great advantage. I'll be willing to pay around 120 Namibian Dollars."*
		Participant 12: "*I will not be interested anymore because why is it being selective when it is not supposed to be?"*
		Participant 13: "*I will not want to use it because I would want to know why only a few people are allowed to use it and not everyone."*
		Participant 14: *"I will not be willing to take part in that. I will prefer things that are being tried and tested."*
9	In what ways will goal setting change the ways you use mHealth apps to manage stress? **(Goal setting)**	**Participant 1**: *"I will use it and it would matter if people were less stressed and happier. So if there was actually an app that would help set goals as to know when one is stressed and when my stress can occur, then I will definitely go for this one."* **Participant 2**: "*It will encourage me because that's like my routine. So if you sometimes write down on paper it helps. It would be reminding you that you should not forget that at this time, you should be doing this or that. That will encourage you to use the app. You will be fond of the app because it will bring changes to your life and you are now committed to your goals."*

		Participant 3: "*I don't think it will affect because it will make me use the app more so that I will know my goal is really set.*"
		Participant 4: "*I have a problem with goals because I am not really a consistent person, but it's a good thing because for you to improve you need to have a goal. I also think it's encouraging for someone doing something. There is an aim that l am aiming for this.*"
		Participant 5*: "It is still fine because I'll be free from the pressure. Everyone has a goal. People set goal and do not even know they set goals. Going to school is setting a goal, but there are goals you set for yourself and most people don't set goals for themselves. So, I like this because one is moving towards something.*"
		Participant 6: "*It will encourage me to use the app and it will give me other things to do.*"
		Participant 7: "*I don't have to set goals for stress. I can choose to ignore certain things.*"
		Participant 8*: "It will encourage me because it is stress that I don't want, and I want to get rid of it.*"
		Participant 9: "*It depends. If I am setting a goal which is to become less stressed and then I am sitting there and waiting; but if the app is telling me the goal to get less stressed, that these are the things we will do, then l think l will do it. .*"
		Participant 10: "*It will encourage me because it's helping me set my own goals.*"
		Participant 11: "*If it sets goals for me, it will actually help me, because that's an encouragement. It is something that says you have to do this. Seeing that on the app will help you strive to achieve that goal.*"
		Participant 12: "*Yes I am going to use it because I am setting goals and you know how it feels. You feel proud of yourself when you achieve the goals.*"
		Participant 13: "*It will encourage me to use it. At least it has a way of checking your progress.*"
		Participant 14*: "It will have an effect on my choices, because I am not targeting on reducing how often I get stressed. My target will be whenever I am stressed.*"
10	How would you respond to an accountability partner	**Participant 1:** "No comment"

	facilitating the use of mHealth apps for stress management? **(Monitoring)**	**Participant 2**: "*Yes I would want it because sometimes when you are on your own, you get discouraged. So if during that time I am using the app and I have a partner that says no you did not do this, I tell myself that I need to keep going . It's really good to have someone.*"
		Participant 3: "*I think it will encourage me to use it because if I forget to go to my app, somebody will remind me to grab my stress management app.*"
		Participant 4*: "It will encourage me because as l said, I am inconsistent. I might have to study for a test and l might be there doing some useless things. So if there is something that reminds me that I have to go for this, it will be better. It's like if you have a friend for instance, let's say you are playing cards and you spend 2 hours and we have to go study because we have a test tomorrow, a friend of mine says no "bruh" let's go study''. You have to go because it's a fact that you have to go study since what you are doing at that time is not really that important. So if that app has a reminder that you have to go do this, then yes l might get it."*
		Participant 6: "*It will encourage me because by me smoking, I will be telling my friend that I smoke every time and it encourages me to use the app.*"
		Participant 7: "*I can't say it will encourage or discourage because, I'm accountable to myself and not someone else. It's my problem, not depending on someone else.*"
		Participant 8: "Po*sitive because it will take my responsibility.*"
		Participant 9: "*No. lt feels like it makes you dependent and l don't like it.*"
		Participant 10: "*it will encourage me because I will be more responsible if I have to report to someone that I've done it again.*"
		Participant 11: "*For me I'll say it will make me use the app less because I'll like some privacy on how I deal with stress and I wouldn't like people asking me how I used the app.*"
		Participant 12: "*it will encourage me because an accountability partner is good to have.*"
		Participant 13: "*It will encourage me, because sometimes you may end up forgetting things. So it is better to have someone to at least remind you.*"
		Participant 14: "*I will definitely use it. It brings in the feeling of being acknowledged.*"

| 11 | What is the effect of having your peers or classmates motivating you to use mHealth apps for stress management? **(Social Role)** | **Participant 1**: "*Not at all. That will be them pressurizing me to do something that l would not want, and l would not want the whole world to see that now am stressed and they come to me offering stress management apps.*"

Participant 2: "*I would want to use it and in life you want to give everything a chance. You want to try it if it works the way you want or if it goes well for you. You continue if it does and if it does not, you stop.'*

Participant 3: "*I will definitely check it out if everyone is telling me about the app; then I will go for it.*"

Participant 4: "*I am kind of a curious person. So if you are telling me there is this app that does this and this l will be curious enough to try it out and see how it's going to work for me.*"

Participant 5: "*Yes, because if I get something in the class, let's say I get some big money, the moment I get to the class, I'll say I have 500 for drinks today. Everyone in our class will see the new thing. They will go tell everyone in the class; not that this one talked to this one and that one. Yes, we share a lot. A lecturer can deliver a certain topic in the class and if it was not well defined, by tomorrow, someone will come say, no, that topic is well defined, I have a soft copy, bring your USB, go read from this page to that page. So, if someone gets an app, for example, one guy would start playing a game and the class mates will join and try it out.*"

Participant 6: "*It will motivate me because he probably experienced stress and he used the app.*"

Participant 7: "*What you do is your choice. I choose what I want.*"

Participant 8: "*Yes. It will motivate me to use it and if they benefited, I will also use it.*"

Participant 9: "*It will if l see changes in them because there are things that people use but they are not really working for them.*"

Participant 10: "*I will try it out and see if it's good. If it is, I'll continue using it. They will influence me to use it. If it does the job, I'll use it. If not, I'll abandon it.*"

Participant 11: "*If I see the app has really helped my mates and they're doing fine, I'll use the app but if they tell me about the app and nothing changes about their stress condition, I wouldn't use the app.*"

Participant 12: "*I will use it because I am sure we are not going to have the same kind of stress.*" |

		Participant 13: *"It will motivate me to use it. I believe in my friends and I believe in their suggestions. So I first have to try it and see if it works."*
		Participant 14: *"I think that will have no effect on my side because maybe their stress is a bit different from mine but as I said earlier on, My interest will be built on the review."*
12	How does earning points on a leaderboard impact your use of a mHealth apps for health conditions improvement? **(LeaderBoard)(Gaming)**	**Participant 1**: *"I would not use it."*
		Participant 2: *"It will encourage me because when I pass a certain level and I get those stars, I will be happy that I have at least done something. It is encouraging and good."*
		Participant 3: *"Definitely because I want to be on top."*
		Participant 4: *"Yes, you might want to be on top you know, so you will also try to get some more points so that you can be on top."*
		Participant 5: *"Yes, those tasks become like goals. If I'm getting stars, that would be fine. Obviously, everyone wants to get the stars. Yes, that will be fine."*
		Participant 6: *"I will use it because every day is like a new change in my life and climbing up the ladder motivates me to do better and work harder."*
		Participant 7: *"I will play when I want to play not because of stress."*
		Participant 8: *"Encourage me to use it because I want to earn those points and if I do, I will be happy, and stress will be gone."*
		Participant 9: *"Yes, maybe, not really sure. I do not like the fact that it's competing and somehow I feel like it's too much information."*
		Participant 10: *"It will, because, at the end of the day, I might end up at the top of the chart and since it's helping me manage my stress as I climb the ladder."*
		Participant 11: *"Receiving badges gives a good feeling. For me, it will encourage me because it'll show I'm climbing and improving."*
		Participant 12: *"It will encourage me since a lot of people are going to see it and it is going to be helping. It is showing improvement and it gives points and also going to help them."*
		Participant 13: *"It will influence me. If am getting marks, I will feel motivated that at least I am achieving something."*

		Participant 14: "*It will motivate me to use it because I will be earning points.*"
13	In what ways would participating in a team effort to address mental health with mHealth apps among students encourage or discourage your participation? **(Cooperation)**	**Participant 1**: "*I would love to participate in it and it's something good that will happen to put something out there, go out there and educate people on how to overcome stress, what to do not to get stressed*."
		Participant 2: "*For me I will try it out with peers. If it works, then I will continue working with them but if I realize that it is not going well for me, I will definitely stop.*"
		Participant 3: "*No, I think I don't want. No, if they are tracking my activity.*"
		Participant 4: *The problem with group is that some people are isolated. They get stressed because of having too many people around them. If someone is too isolated, he or she might not work for him but for me it can work. If you are on a team you can go forward.*"
		Participant 5: "*In term of my class, we'll do it together. We go jogging together and drink together.*"
		Participant 6: "*I would like it because through that people are sharing different ideas and out of that you can get something different from yours; something that could be better than yours. I don't have a problem with working in a group.*"
		Participant 7: "*No effect. I want what I want. I want money.*"
		Participant 8: "*No, I will not use it; it will give me more work and more stress if others do not want to cooperate.*"
		Participant 9: "*I think it will be great. It's like meeting someone you have a lot in common with and trying to get to one point. It's always nice and in that way, you are not competing. You are just helping each other get to the top.*"
		Participant 10*: "I will participate because, team work is nice. You share experience with your team especially those you have daily routines with. You'll be able to share and learn how they manage their stress so that you will not be stressed, and they will give ideas.*"
		Participant 11: "*I wouldn't use it. Because I am dealing with stress, it is personal and I don't want to share such things*."

		Participant 12: "*It will encourage me because if you are in a group, those people can actually help you out and it is going to be helpful. Those people will cheer you up.*"
		Participant 13: "*It will encourage my participation because obviously when you are doing something you might end up getting stressed. So if you are on a team, it is better.*"
		Participant 14: "*I will be discouraged as I regard status personal.*"
14	How does your environment influence the use of mHealth apps for stress management?	**Participant 1**: "*It would not matter because I am with my phone and I am using the app on my phone to relieve my stress and the app is not in the environment but on the phone.*" **Participant 2**: "*It depends on the environment. I love nature. If the environment is full of trees then I would want to use the app but if the environment is not good, I will not use the app.*" **Participant 3**: "*it won't affect. Or maybe when it becomes hotter, I might want to use it more.*" **Participant 4**: "*I do not think so because sometimes the app might be offensive to others and sometimes you have to be cautious of other people. So as long as it does not affect the people around, it might not matter to me.*" **Participant 5**: "*I can survive anywhere; it may take one week but I will adapt. Situations don't really matter.*" **Participant 6**: "*Yes it matters because some people that are around you can have bad influence on you.*" **Participant 7**: "*Environment does not matter as long as I can access what I need.*" **Participant 8**: "*The internet is important to have. The surrounding does not matter.*" **Participant 9**: "*I sleep a lot; not much these days but if am in my room and comfortable, I do not think I will use an app.*" **Participant 10**: "*When I'm in my room or at home, I'll be able to use the app. When I go to a noisy place, I won't be able to use the app.*" **Participant 11**: "*maybe It does, but for me, it doesn't matter. Noisy, quiet, I fit in everywhere.*"

		Participant 12: "*The environment is just an environment and it is not going to be hurtful all the time. So I would rather use the app.*"
		Participant 13: "*No I don't think it really matters since the app is the phone and you can use your phone any way.*"
		Participant 14: "*Not sure how I will connect environment and my decision to use the app, I think I will use it in a good environment but I will use it either way; whether it is a noisy environment or a cool environment. If it is helping my stress, I will go for it.*"
15	In what ways does the interface of an mHealth app for mental health motivate you to use it for managing your stressful conditions? **(Interactive)**	**Participant 1**: "*It would matter because no one will want to go to a mental health app and find a funny interface. So the interface has to be captivating for me to be intrigued by it and for me to want to know more about it.*"

Participant 2: "*It does not matter because sometimes things can look beautiful but when you start using it, it does not actually give you what you wanted.*"

Participant 3: "Y*eah, I think so. It might just correspond to stress things. When I'm stressed, I want to see fine things; maybe flowers.*

Participant 4: "*A welcome text has a tone that might make the person feel good about themselves. The interface does not really matter as long as it is fine and it can make someone happy.*"

Participant 5: "*No. Iif you like the app, even if it changes to black or red, as long as the app is helpful, you keep on going. It just like alcohol. You know this thing is burning me, you still keep pushing. Cars kill, but people still use them.*"

Participant 6: "*Yes, it matters. It should be attractive, encouraging and not discouraging you.*"

Participant 7: *I don't mind. I just care about the information that I want. That is, the functions.*

Participant 8: "*It will matter. I need the interface to be attractive.*"

Participant 9: *It shouldn't be an annoying looking app. It should be a decent one that will make me want to embrace it.*

Participant 10: "*I think it will affect me. For example, if an interface is not attractive, I won't even bother downloading that app. The interface must be attractive.*"

Participant 11: "H*ow the app looks matters. The more one opens it, it must excite you and encourage you. So interface matters.*" |

		Participant 12: "*It does not matter how it looks because what I want is to be helped than to look at the interface.*" **Participant 13**: "*It might affect it because people like nice things and it will encourage me to use it if it looks nice so that I do not get bored.*" **Participant 14**: "*If it is not user friendly, it will discourage me but if it is user friendly, I will go for it.*"
16	How does the time-based or periodic schedule engagement of mHealth apps work for you? **(Periodic)**	**Participant 1**: "*It will not because I feel like this app will replace most people but they will not have time to check up on you and see how you are doing. So if an app like this is to be created, it would actually help.*" **Participant 2**: "*No, I would not want that because if it brings on a reminder and something important comes up, I would not go with the reminder. I will have to do that thing that is important.*" **Participant 3**: "*I think it will encourage me to use it because it gives an update per time.*" **Participant 4**: "*The problem is personal. I am not consistent I might do it today but tomorrow I might not. I will just wake up, pack my things and go to school.*" **Participant 5**: "*It depends on how often you get the pressure because a week can pass before getting pressure, and the app must be set according to the person. So, the person should be able to set it for himself.*" **Participant 6**: "*Not really because every time it is reminding me, it would sometimes be tiring, and I could feel like just ignoring it.*" **Participant 7**: "*Yes, because I can choose. If I choose that it should remind me, then fine. As long as I can choose when it will remind me.*" **Participant 8**: "*No, it will not work for me because it will use up my time.*" **Participant 9**: "*I would love an app I can interact with, but it should not be time based because stress comes anytime.*" **Participant 10**: "*Time-based will be a problem, but if it's periodic like five (5) hours, it will be good.*" **Participant 11**: "*I won't motivate you because sometimes you may not be disposed to doing what it instructs you to do. But if I know it's helping me to manage the stress, I will be motivated, even at a particular period*".

		Participant 12*: "It will discourage me because waiting for a while is not good when you are stressed. You just need that help so quickly. So it's not good thing for you to wait again*."
		Participant 13: "*It will discourage me because you never know when the stress comes.*"
		Participant 14: "*I would not be willing to use it. Like I said, the more reminders, the more it is engaging. When I do not need it, then it became a nuisance.*"
17	How motivated are you to use mHealth apps for stress management if it gives a valid scientific argument or facts about its effectiveness? **(Authority) (Credibility)(Persuasive Communication)**	**Participant 1**: "*I will not really be motivated by something scientific as we all know science is just about assuming and guessing. So it would not really be precise as if it gives valid effectiveness.*"
		Participant 2: "*It will motivate me because it is effective, and I would want to try it and if it is not effective, I will stop using it.*"
		Participant 3: "*I would use it because I want result, like 100%. I'm sure because they say it works scientifically. I trust science.*"
		Participant 4: "*Yes, I will go for it because it's good for me, it can reduce my stress and if it's scientifically proven. l also believe in science after all because l am doing sciences.*"
		Participant 5*: "Scientific proof will encourage one to use the app."*
		Participant 6: "*It will encourage me because it is scientifically proven, and I believe science.*"
		Participant 7: "*Yes, I believe in science.*"
		Participant 8: "*it will encourage me to use it more often because since it is scientifically proven, I would want to use it.*"
		Participant 9*: "l would use it if am stressed."*
		Participant 10: "*I will use it because science is the answer to everything. Science comes with medicines and we use even vaccines for ailments like corona virus. When you're stressed, it has to do with your mind, but if science says an app works, I will use it. I trust scientific facts.*"
		Participant 11: "S*cientific prove will motivate me very much because for them to say that, they must have tested it and seen the good results it produces. So, I'll be motivated to use it.*"

		Participant 12*: "I am going to use it because it is scientifically proven. So there was some research done that it can help reduce your stress and it can be helpful."* **Participant 13**: "*I am more than likely to use it if it is scientifically proven. I will use it."* **Participant 14**: "*I will be more than willing to use it. I will feel very motivated because it is meeting my personalized need. I will know that it is scientific and it means it has been tried and tested."*
18	How motivated are you to use an mHealth app for stress management if you find the profile of the person on apps fits yours? **(Liking)**	**Participant 1**: "*No one would understand the level of stress you are under or the stress you go through. So you are the only person that would know what fits you. Let me say you and I will not have same stress."* **Participant 2**: "*It will encourage me because sometimes celebrities go through a lot and you look up to them. So since they believe that the only way they could do this was through that app then I believe I should use that app since it helped them."* **Participant 3**: "*I would use it because if a celeb can use it, and I feel like they have anything that they want to manage their stress, I think, I'm going to use it."* **Participant 4**: "*For me, I do what is good for me, and people are different. What might work for another might not work for you."* **Participant 5**: *Obviously, motivation from those famous people will help.* **Participant 6**: "*It would encourage me because if it's my role model using it, I would also use it."* **Participant 7**: "I*t depends on how I feel on that particular day. I'm different, I'm me. It depends on me.*" **Participant 9**: "I*t would be great."* **Participant 10**: "*I will because someone I look up to is on the app."* **Participant 11***: "It will motivate me because I'll feel I'm no different from everybody else. People feel this. In fact, celebrities also feel this. I'll feel like, it's not just that I'm being too much or what. I'll feel like everyone goes through this."* **Participant 12**: "*I am going to be motivated because someone with high profile advices someone to use the ap. It would be nice to use what a celebrity is using."*

		Participant 13: *"it will encourage me because there are certain people who motivate you."*
		Participant 14: "*Definitely the review is important to me if someone else has found it important or helpful. I will try and use it as well.*"
19	What level of impact will the expectations set on an app affect your decision to use or not use? **(Expectation) (Commitment and Consistency)**	**Participant 1**: "*I never live up to expectations. This app and other apps have their own expectations. l might join it and if l don't meet the expectations that they put there, it would be of no use.*"
		Participant 2: "*Well for me I will not. sometimes things go wrong and maybe I did not get it very well and I would not want it to have expectations because maybe my stress is still a lot and will take more time for Me to deal with it.*"
		Participant 3: "*it will encourage me because I want to meet that specific expectation on the app."*
		Participant 4: "*I think yes like that it's also improving your knowledge. For example, you log into an app and there is a part of mathematics and a whole part of science. Then l will go for that story and in the process, its helping me increase my knowledge."*
		Participant 5*:" It will encourage me. That is just like the goals we talked about. If the app says, at the end you'll get this, everyone would want to reach that goal."*
		Participant 7: "I*t depends on what it expects of me and what my goal is.''*
		Participant 8*: "Yes, it will because of those expectations that I will want to achieve."*
		Participant 9*: "No because not everyone reaches expectations and if that does not happen, one tends to stress more."*
		Participant 10: "I *will use the app. Because, just like the periodic question you asked me, if it expects me to do something, I will because at the end of the week, you will even see what you have achieved.*"
		Participant 11: "*It depends on how severe the stress is. If you have something you're stressing on and the app keeps reminding you of the stress, and you can't find a way of resolving the task, it will be more pressure to you. However, it can also be in a positive way, If the app reminds you of a task, it can also motivate that you have a goal, and if you feel it's not that hard, it will end up in a positive way."*

		Participant 12: "I*t will encourage me because I am going to work on that. It is that good that after some time you are not going to be stressed anymore and it will work for me at the end of the day."*
		Participant 13: "*It will encourage me; it is something that I trust."*
		Participant 14: "I *will try to use it. If I reach those expectations and, in the end, it would be able to help manage my stress I will go for it."*
20	How will mHealth apps for stress management with emotional features like humour, joy and sadness faces encourage your use of it**? (Self-monitoring) (emotion)**	**Participant 1**: ''*I would go for such an app. So if the app has emotional faces and will just be writing how you are feeling using emotions, I would use it*."
		Participant 2: "*It would be effective and if I see smiley faces, I will like it and I will smile too."*
		Participant 3: "*It will motivate me because if I log on to an app and then I see a sad face and I'm sad, I'll want to smile."*
		Participant 4: "U*sually when you use emojis, when you receive a funny emoji it will lift up your mood. If you were sad and you get a funny emoji, it will lift your spirits."*
		Participant 5: "I*t will be good if the app shows smiley faces and if I can express myself with that on the app."*
		Participant 6: "I*t matters. By showing emotions, I will feel as though I am speaking to it through those emotions and it will make me use it."*
		Participant 7: "*Yes, I like smileys because I'm a happy person."*
		Participant 8: "*It will encourage me, and it will make me happy."*
		Participant 9: "*I love emojis and I would use it*."
		Participant 10: "it will encourage me because emojis speak a lot."
		Participant 11: *"Depending on how one is feeling right now and you'll get yourself into the space where you'll question why you're feeling sad and how you can control or manage the state or mood."*
		Participant 12*: "I will be encouraged because emojis also help you express the feelings you have; they help you connect to emotions."*
		Participant 13: "*It will encourage me because sometimes when you have stress and you see smiley faces you will obviously be attracted."*

		Participant 14: "*I will still use it because it's like having graphical information of how I am feeling.*"
21	How does positive or negative enforcement of your behaviours by mHealth apps for stress management encourage your use of it for your stress conditions? **(Reward/Positive Reinforcement Negative reinforcement)**	**Participant 1**: "*I would use it because it would actually help me not .do the wrong thing.*"

Participant 2: "*Yes, it will. It is reminder that you are not supposed to do something, and you will be aware of your goals.*"

Participant 3: "I*f it is positive, it will motivate me but if it's in the negative way, I think it will discourage me because if I don't use the app, I will be like I'm getting bad. I could be told I'm doing bad, but this is a stress app. I'm already stressed so telling me that I'm doing bad won't motivate me.*"

Participant 4: "N*ot really. The purpose of the app is to reduce someone's stress so it must be positive. You cannot be a social worker and be counselling someone, but be onthe negative side*.

Participant 5: *Yes, that is good because sometimes, I might be doing something wrong and I don't know it's wrong. Like I can laugh at a person failing and when it's my turn I should laugh also at the person. It will work if we are told we are doing good and told we are doing badly.*"

Participant 6: "*It will encourage me because when a person is really in love, they need motivation to keep going not discouragement. That will keep you moving you backwards and if I did something wrong and the app tells me, it is also good.*"

Participant 7: "I*t's what I like doing. If I like what you don't like and you mock me, it doesn't matter. Yes, I will like this feature because I want all the positivity I can get. As long as it's going my way.*"

Participant 8: "*It will encourage me to use it more often. I will like compliments such as good job at what I am doing.*"

Participant 9: "*I don't think it would the negative enforcement because it will just bring me but if I have an app that tells me I have done something positive; (not that it's a must) if it tells me once positive stuff once in a while, I would love that.*"

Participant 10: "*I will use it, because I will not only want to see what I'm doing right but also what I'm doing wrong. And I'll like to be motivated when I'm doing right.*"

Participant 11: "*if it notifies me that I'm doing well and good, I'll feel good about myself. Then it's a positive result, and if it scolds me, it will drive me to do better.*" |

		Participant 12: "*I will want it, because it seems the app cares about my health.*"
		Participant 13: "*It will encourage me, because I am someone who really needs to know my status so I know where I went wrong and so I can correct that part.*"
		Participant 14: "*It will encourage me, because I am someone who really needs to know my status so I know where I went wrong and so I can correct that part.*"
22	What do you think of mHealth apps for stress management that give you recommendations, suggestions or advice? Will that motivate your use? **(Suggestions and Kairos)**	**Participant 1**: "*It would not motivate me to use it in any way because what will be the suggestions? The reason why I am now using a certain app for stress is because I know what I need to do. So an app suggesting what I need to do will be totally wrong.*"
		Participant 2: "*Yes I will be encouraged because the app is recommending things for me to do and I will be experiencingYdifferent things and it will not be the same thing over and over again.*"
		Participant 3: "*I think it's a very good idea because say for example, the app recommends that you do a specific thing and it help me, then I know it's a very good app. I will use it definitely.*"
		Participant 4: "*Yes, it will encourage me, and I will use it and also if it works for me I would also recommend it to my friends.*"
		Participant 5: "*Yes, advice on what you must improve on; it will be good.*"
		Participant 6: "*It will encourage me; it will keep telling me what to do and what not to do.*"
		Participant 7: "*Yes, if it advises on the direction I'm going.*"
		Participant 8: "*It will encourage me more since it is giving me some motivation.*"
		Participant 9: "*I think I would love an app that will tell me I have stress and give me advice at the same time.*"
		Participant 10: "*I will use the app because it will help cope with my stress when it tells me what to do or not, and it even gives recommendations especially as a student.*"
		Participant 11: "*It will be good if it gives me recommendation but preferably to give you that ability to also ask you how you're feeling right now. How*"

		would you like to deal with the situation? Would you like to do this or that? It must also give me the ability to proffer solutions. More interactive in fact."
		Participant 12: *"I will be motivated to use it because it is helping me out. The app will be acting like an adviser."*
		Participant 13: *"It will motivate me. So if you are given a recommendation, it's more like you are given a frame wok to follow. It is nice."*
		Participant 14: *"I wouldn't use the app, because as I said that whenever I am stressed I just need it to help me."*
23	Please how will you use mHealth apps for stress management that engage you in some simulation or role-playing activities? (**Simulations)(Role-playing)**	**Participant 1**:*"In all honesty, this will be 0%. There will be no motivation because if I am using the app for stress management, I would not want it to make me participate in role play and stuff because l am using this stress management to help me release my stress and not help me want to be someone I am not."*
		Participant 2: *"It would encourage me. Sometimes an app will have you do those things and it ends up bringing out laughter. I would feel like it's relieving me of stress."*
		Participant 3: *"It will encourage me. Let's say for instance, if it says I must do something like spider man, and they want me to release that stress, it's a good thing."*
		Participant 4: *"The problem is that if the phone is telling me to jump out l will not do it because it's a phone. For example if you set an alarm, if it rings you have to wake up or snooze it and sleep. If am busy with something l might not do it."*
		Participant 5: *"Nice, if the app will make you a chief or give you a position, it's nice because there will be a time, I will enjoy my position. That will be good."*
		Participant 6: *"It will discourage me, and it will bring too much pride in my life and that is not good."*
		Participant 7: *"It will encourage me. Since I can pretend to be what I want to be."*
		Participant 8: *"I will be encouraged to use it frequently."*
		Participant 9: *No, thinking of having such an app; how that will help me, me pretending to drive."*
		Participant 10: *"I will use it because I will be catching fun."*

		Participant 11: *it will help me to be in that person's space for a moment, thus motivating me to use the app. So, it will provide a positive result.*
		Participant 12: *I will not use that because the suggestions are not really that good.*
		Participant 13: *It will encourage me. It depends on the time. If am busy, I won't be able to follow up but if am not busy I will follow, and it is okay.*
		Participant 14: *It has no impact. I would not want to listen to the app.*

4.2.6. ANALYSIS

The previous section presented the findings of the interview with participants based on the components identified from the literature. The components were updated based on the findings of the participants. The criteria for adding or removing components are hereby presented in Table 4.4.

Table 4.4: Criteria for Adding and Removing Components

Number of Participants Selecting an Element Relevant	Add to the List of Relevant Elements
0	No
1	No
2	No
3	No
4	No
5	No
6	No
7	Yes
8	yes
9	Yes
10	Yes
11	Yes
12	Yes

13	Yes
14	Yes

The researcher resolved that when eight or more participants regarded an element relevant it should be added to the list. The researcher also added the Awareness element from section A (piloting questions). The elements listed below were identified by the students as relevant.

4.2.7. FINDINGS

The findings are presented in Table 4.5. The first column describes the elements, the second states whether it was added or not and the last column lists the participants that accepted the elements.

Table 4.5 Criteria for Including and Excluding Elements of Persuasive Strategy.

Number	Elements of Persuasive Strategies for mHealth Apps for Stress Management	Included	Accepted/Recommended by
1	Awareness	Yes	3,4,5,8,9,10,11,12
2	Personalization	Yes	12,3,4,5,6,7,9,10,11,12,13,14
3	Mindfulness	Yes	2,3,4,5,6,9,10,11,13,14
4	Reminder/ Tunneling	Yes	1,2,5,6,8,10,11,12,13
5	Self-tracking /Self-monitoring	Yes	2,3,5,7,8,9,10,11,12,13,14
6	Social Competition	Yes	2,3,4,5,6,7,11,12,13,14
7	Anonymity	Yes	1,2,5,7,8,1011,13
8	Reward/positive Reinforcement	Yes	2,3,5,6,7,8,9,10,11,12
9	Scarcity	No	3,4,8,9
10	Goal setting	Yes	1,2,5,6,8,10,11,12,13
11	Monitoring	Yes	2,3,4,6,8,10,12,13,14
12	Social Role	Yes	2,3,5,6,8,9,10,11,12,13
13	Leaderboard Gaming	Yes	2,3,4,5,6,8,9,10,11,12,13,14
14	Cooperation	Yes	11,2,4, 5,6,9,10,12,13
15	Environment	No	2,6,10
16	Interactive/ Interface	Yes	1,3,6,8,9,10,11,13,14
17	Periodic/Time	No	3,5,7,9

18	Authority /Credibility Persuasive Communication	Yes	2,3,4,5,6,7,8,9,10,11,12,13,14
19	Liking	Yes	2,3,4,5,6,9,10,11,12,13,14
20	Expectation / Commitment and Consistency	Yes	3,4,5,8,10,12,13,14
21	Self-monitoring / Emotion	Yes	1,2,3,4,5,6,7,8,9,10,11,12,13,14
22	Reward/Positive Reinforcement Negative Reinforcement	Yes	1,2,3,5,6,7,8, 10,11,12,13,14
23	Suggestions and Kairos	Yes	2,3,4,5,6,7,8,9,10,11,12,13
24	Simulations /Role-playing	Yes	2,3,5,7,8,10,11,13
25	On-Demand	Yes	14

4.2.8. SUMMARY

The purpose of this chapter was to present elements of persuasive strategies to facilitate the use of mHealth apps for stress management by NUST students. The study initially identified twenty-four (24) elements of persuasive strategies that are useful to motivate the use of mHealth apps for stress management from literature. Based on the findings from the participants, three elements were removed. An element (On-demand) recommended as a desirable element of persuasive strategy by the students was added. The new list was then presented to experts, mobile developers and mental health experts in Namibia for validation. The findings are presented in chapter 5.

Table 4.6 List of Acceptable Elements of Persuasive Strategy according to NUST Students.

Number	Elements of Persuasive Strategies for mHealth Apps for Stress Management
1	Awareness.
2	Personalization.
3	Mindfulness.
4	Reminder/ Tunneling.
5	Self-Tracking /Self-Monitoring.
6	Social Competition.

7	Anonymity.	
8	Reward/Positive Reinforcement.	
9	Goal Setting.	
10	Monitoring.	
11	Social Role.	
12	Leaderboard Gaming.	
13	Cooperation.	
14	Interactive/ Interface.	
15	Authority /Credibility Persuasive Communication.	
16	Liking.	
17	Expectation / Commitment and Consistency.	
18	Self-Monitoring / Emotion.	
19	Reward/Positive Reinforcement. Negative Reinforcement Element.	
20	Suggestions And Kairos Element	
21	Simulations /Role-Playing.	
22	On-Demand.	

CHAPTER FIVE

RESULTS AND ANALYSIS: DESIGN SCIENCE RESEARCH

5.1 INTRODUCTION

Chapter three presented the phase 1 of the DSR research and the literature search of existing elements of persuasive strategies in existing literature.

Chapter four discussed the development and evaluation of initial strategies and guidelines by NUST students, with structured interviews being the research instruments to collect data. The findings created the guidelines (artifact).

Chapter five detailed the development and validation of the intermediate recommendation and guidelines by experts plus the development of final Guidelines and Recommendation.

This chapter focuses on the evaluation of the design process and addresses the research question posed in chapter one (section 1.4):

- **What elements of persuasive strategies were found to be relevant to mHealth applications for stress management among university students in Namibia as determined by professionals in mHealth applications development practice?**

This chapter also addresses the research sub-objective described in chapter 1 (section 1.5).

- **To validate the elements of persuasive strategies in mHealth applications relevant to support stress management among university students in Namibia as determined by professionals in mHealth practice.**

Figure 5.1, highlights the validation of the intermediate recommendation and guideline by experts and their final development.
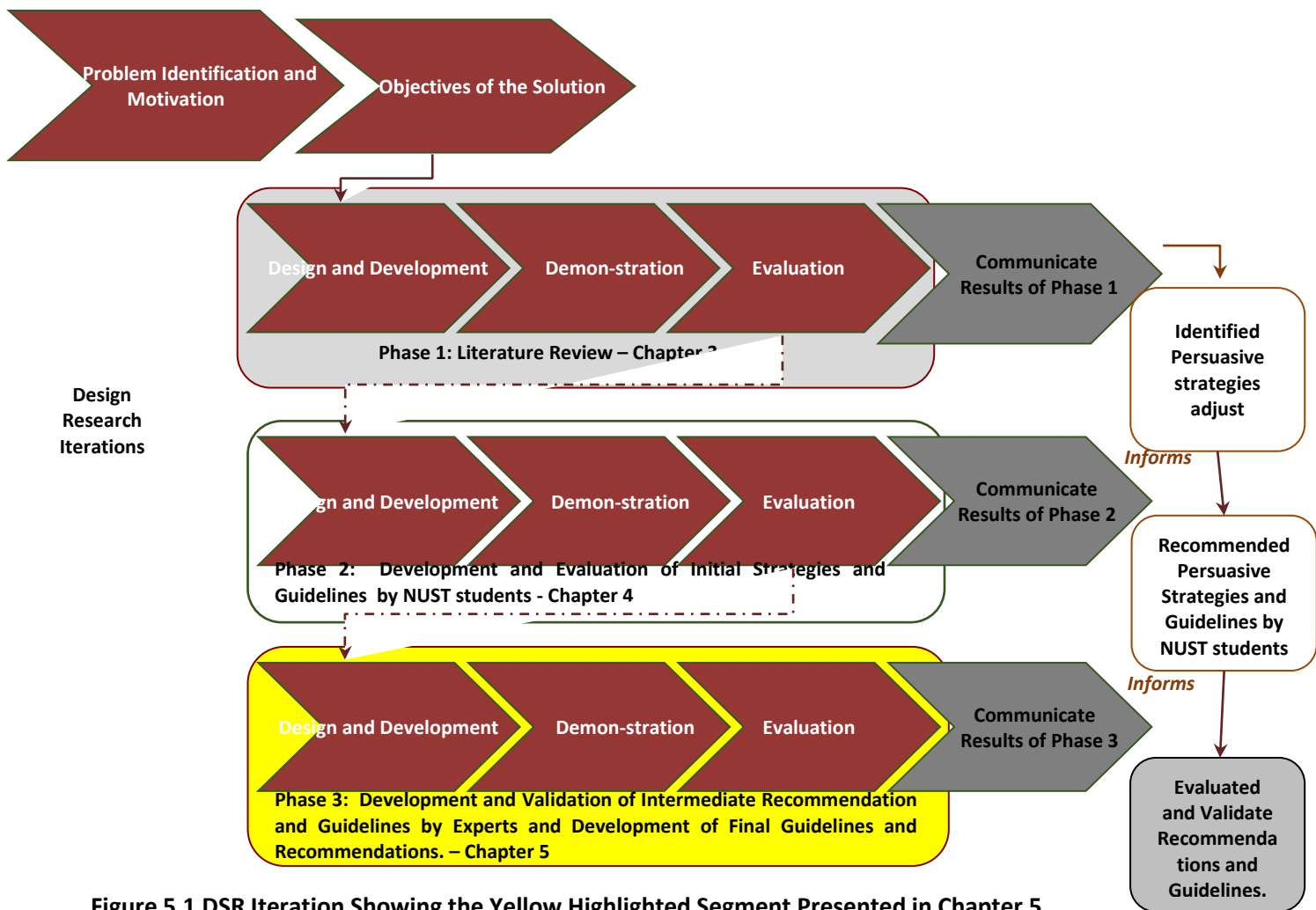
Figure 5.1 DSR Iteration Showing the Yellow Highlighted Segment Presented in Chapter 5.

The research instrument is explained and the structured interviews are described in the following section.

5.2. THE RESEARCH INSTRUMENT

In order to evaluate and validate the intermediate recommendations and guidelines by experts as well as aid the final development of final same, structured interviews were conducted to gather data (Appendix 3).

The sample size was five. This was guided by the requirement of the research philosophy interpretivism, which is usually characterized by small sample sizes (Iyawa, 2017).

At saturation, the interviews were stopped when there was no new data from the interviewees (Weller et al., 2018).

5.2.1 STRUCTURED EXPERT INTERVIEWS

This section of the study included an individual interview session with each expert. Five (5) experts participated in this process. Each expert chose the most convenient venue and time for their interview. Each interview was approximately thirty-five (35) minutes long.

The interview questions included the intermediate guidelines and recommendations of the selected elements of persuasive strategies.

Table 5.1 Structured Interviews.

Structured Interviews	Number	Question (Persuasive Element)	Objectives
	1	**Mindfulness** Do you believe regular reminders on mHealth apps for stress management will work for students to be mindful of their stress conditions?	The objective of this question was to find out whether a persuasive element that calls a student's attention to their present moment and that is non-judgmental will motivate the student to use the mHealth app.
	2	**Reminders** or **Tunneling** Do you think reminders will facilitate the use of mHealth apps for mental health by students? Why?	The objective of this question was to know whether the element that will lead users through predefined steps for accomplishing the target behaviour and guide them from distracting actions will be relevant.
	3	**Self-Tracking** or **Self – Monitoring** Can self-tracking features on mHealth apps help students manage their stress?	The objective of this question was to know whether allowing students to monitor themselves to inform them about how they might modify their attitudes or behaviours to achieve a desired goal or outcome will be relevant to their use of mHealth apps for stress management
	4	**Social competition**	The objective of this question was to know whether providing means for a user to compete with others

		What level of competition do you think will be appropriate to attract students to use the mHealth apps for stress management?	will facilitate their use of mHealth apps for stress management.
	5	**Anonymity** Will students sharing their mental health status anonymously encourage the use of mHealth apps for stress management?	The objective of this question was to know whether if the opportunity to be faceless or secretive or anonymous will facilitate the use of mHealth apps for stress management.
	6	**Reward/Positive Reinforcement** Does reward for using mHealth apps for stress management affect or encourage its use?	The objective of this question was to know whether offering virtual rewards to users for performing the target behaviour on an app will be relevant or motivate the use of mHealth apps for stress management.
	7	**Scarcity** Does paid subscription motivate the use of mHealth apps for stress management among students especially with gold status for those paying?	The objective of this question was to know whether apparent shortage will bring about demand to use mHealth apps for stress management.
	8	**Goal Setting** Will goal setting change the ways you use mHealth apps by students to manage stress?	The objective of this question was to know whether allowing users to set behavioural or stress level goals will motivate the use of mHealth apps for stress management.
	9	**Monitoring** Have you found any positive or negative response to accountability partner features of mHealth apps for stress	The objective of this question was to know whether allowing one party to monitor the behaviour of another will motivate the use of mHealth apps for stress management.

		management by students?	
	10	**Social Role** Do you think that peers or classmates motivate students to use mHealth apps for stress management?	The objective of this question was to know whether social encouragement, feedback, etc will motivate NUST students to use mHealth apps for stress management.
	11	**Leaderboard/Gaming** Does earning points on a leader board impact student use of a mHealth app for health conditions improvement?	The objective of this question was to know whether the use of Gamification, that is, the use of game elements in nongame contexts, is aimed at making interventions (including mobile apps for behavior change) more enjoyable, motivating, and engaging relevant to the use of mHealth apps for stress management.
	12	**Cooperation** Does participating in a team effort to address mental health with mHealth apps among NUST students encourage or discourage your participation?	The objective of this question was to know whether requiring the users to cooperate (work together) to achieve a shared objective is relevant for NUST student to use mHealth apps for stress management.
	13	**Environment** Does the environment of use influence students' adoption of mHealth apps for stress management?	The objective of this question was to know whether a computing technology that is visually attractive to target users is likely to be more persuasive as well facilitate the use of mHealth apps for stress management.
	14	**Interactive** Does the interface of a mHealth app for mental health motivate students to use it for managing their stressful conditions?	The objective of this question was to know whether a computing technology that is visually attractive to target users is likely to be more persuasive to facilitate the use of mHealth apps for stress management.
	15	**Periodic** Does a time-based or periodic schedule affect students' engagement of	The objective of this question was to know whether the ability to select various time intervals for any of the preferred activity types will facilitate the use of mHealth apps for stress management.

		mHealth apps for stress management?	
	16	**Authority** Will logic or appropriate facts sharing about students' stress condition motivate them to use mHealth apps for stress management?	The objective of this question was to know whether credible sources of information present good arguments in favour of the use of mHealth apps for stress management.
	17	**Personalization** Is customization or personalization effective in encouraging NUST students to use mHealth apps for stress management?	The objective of this question was to know whether personalized contents and services to a student's need will motivate his or her use of mHealth apps.
	18	**Expectation, Commitment and Consistency** Does setting expectations on the app motivate the use of mHealth apps for stress management?	When individuals have decided to implement a goal or commitment, they are likely to pledge their commitment to the idea or objective as being like their personality. The objective was to find out whether individuals are likely to continue with this obligation even if the initial motive is removed.
	19	**Self-monitoring, emotion** Are emoticons or persuasive images likely to encourage the use of mHealth apps for stress management by students?	The objective of this question was to know whether affordance, playfulness, emotions, humour or sorrow to depict the feelings of the user will motivate the use of mHealth apps for stress management.
	20	**Reward/Positive Reinforcement/ Negative Reinforcement** Does positive or negative enforcement of NUST students' behaviours by mHealth apps for stress	The objective of this question was to know whether offers of virtual rewards to users for performing the target behavior will be relevant to the use of mHealth apps for stress management.

		management encourage use?	
	21	**Suggestions and Kairos** Do you think students will be motivated to use mHealth apps for stress management that give them recommendations, suggestions or advice?	The objective of this question was to know whether suggestions of certain behaviors (for achieving favorable outcomes) to the users during the system use are relevant to the use of mHealth apps for stress management.
	22	**Simulations or Role-playing** Do you believe mHealth apps for stress management that engage in some simulation or role-playing activities will be popular?	The objective of this question was to know whether allowing users to perform behaviour in simulated situations will motivate them to use mHealth apps for stress management.
	23	**On Demand** (recommendation)	The objective of this recommendation was to know whether on-demand triggers for mHealth apps for stress management will be suitable.

Transcription, Code and Analysis Procedure – Using the light widget study, experts with varied backgrounds were included. There were two HCI experts with data display experience; a volume visualization expert; a graphic design expert, and a medical imaging physicist (an end user).

The experts provided expertise and gave a wide variety of opinions and insight. They explored several data sets and searched for identifiable objects (a key).

5.2.2. TRANSCRIPTION, CODING AND ANALYSIS PROCEDURES

The interview sessions were digitally recorded and were later transcribed verbatim. Notes were taken during the interviews and also transcribed.

Only segments of the recordings that included the experts' reviews of the guidelines and recommendations were documented (Creswell, 2014,). All the experts gave their consent before the interviews were conducted.

The next section provides information on the experts.

5.2.3. THE EXPERT REVIEWER IN THIS STUDY

Experts are those with valuable user experience and insight in mHealth apps development (Tory & Moller, 2016). The selection of each reviewer or professional was through a referral process. There were three females and two males.

Two of the reviewers were highly qualified NUST students' counselors with several years of experience. The other three (3) included a user interface designer, an IOS app developer and a mobile app developer with varying degrees of experience ranging from between three (3) and five (5) years.
Table 5.2 provides some background information on the experts.

Table 5.2 Expert Reviewers' Profile

Participant	Gender	Field of Practice	Number of Years of Experience
1	Male	UI/UX Designer	5 years
2	Female	IOS App Developer	3 years
3	Female	Social worker	25 years
4	Female	Therapist	6 years
5	Male	Mobile App Developer	3 years

5.2.4. STUDY LOCATION

All the expert reviewers are professionals who reside in Windhoek City, the capital city of Namibia. NUST is also situated here, in the country's central highlands of the Khomas Region. Windhoek has an estimated population of about 410,000 (World Bank, 2020).

The government of Namibia, through the Ministry of ICT put in place several progressive policies to assist the acceleration of ICT development as an enabler of the economy (CRAN,2016). The county's mobile subscription is about 2.66million (S. O'Dea, 2020).

Windhoek is positioned as the center of the digital transformation gradually brewing in the southern African nation, and the Namibian telecom sector is a major contributor to the economic activities of the

country (MICT, 2017). With the presence of three (3) tertiary institutions and host to the corporate headquarters of several Namibian companies, Windhoek boasts the Nation's finest professionals. Today, this city is at the centre of innovation hubs and app developing groups (ICTSummit 2019).

The next section presents the findings of the expert reviews.

5.2.5. FINDINGS

The findings are presented in Table 5.2.

Table 5.2 Elements of Persuasive Strategies from Expert Reviewers:

	Expert Reviews of Persuasive Strategies.	
	Interview Questions	**Interview Responses**
1		**Expert 1:** "I think I will put it this way. To have direct communication with the student, to receive something direct, it should be optional because if you look at students' persona, there is a range, a wide range. For some that might be something that might annoy them. It should be something one can opt out of or something one can opt into but the same way you have billboards around, you can notify them and reminders in their space, but not directly to their devices. You can give the students while onboarding the application. Do you want us to send you stress reminders or checkups? You can opt into or opt out. Again the reason why I said, the options for opt in or opt out is because it will work for some and it will not work for others. I can be very self-aware and I can know when I am under pressure - if I have an app reminding me that I have stress, that might cause anxiety, as long as it is optional 50/50."
	Do you believe regular reminders on mHealth apps for stress management will work for students to be mindful of their stress conditions? **(Mindfulness)**	**Expert 2:** "OK to have. It depends on how regular is regular. As an app developer, an app that constantly reminds you can be annoying. The app might be uninstalled because it is annoying. It depends on how regular is regular; maybe two or three times in a day. I will recommend that because it will make sense. It will keep the user aware of their status, based on the app."

		Expert 3: "Yes definitely, I think, when we, in today's world have busy lives. We do things constantly, and we sometimes are aware of stress but we don't get to the point where we deal with it; and I think if you have a reminder; or an app that tells you every morning at 9 o, clock you have to do some meditation, because meditation is part of stress management, then you will be reminded. Otherwise you become so busy, you forget. So, reminders like an alarm will definitely help us."
		Expert 4: "I 100% believe that because most people aren't automatic, so if you have something to remind you in fact I use the same techniques with my clients to set alarm on their phones, so that every hour they remember to be mindful, reflect 5/5 , 100 percent positive."
		Expert 5: "Yes, because it will help them to be aware of their stress."
2	Do you think reminders will facilitate the use of mHealth apps for mental health by students? Why? **(Reminders)** or **(Tunneling)**	**Expert 1:** "If they have chosen to use the app, then a reminder may work. The download and setting of the app is something the students want. If you were getting notifications from an application, you did not necessarily want to download, those are annoying. If it is something you took upon yourself then those will be beneficial. "

Expert 2: "Yeah, I think it will be helpful. I am still a student myself. I am doing my Masters. Sometimes, I experience a lot of stress. So I think it will be helpful if you have reminders in all, to facilitate in an app, in my own opinion."

Expert 3: "Yes, definitely, I think it is very much related to the first one. It is, like you know you have stress, let me say like apps that remind you that you have to drink water. You know if it reminds you then you do it, and of course, if you do meditation, your stress will become less. So yeah definitely."

Expert 4: "I think it depends on the user. With my clients. Again some people will set the alarm, some will hear the alarm go and they will just quieten the alarm and continue with their activities. For some people the alarm |

		will lead them to access the email or resources to actually feel better but other people will just ignore the reminder. So it will depend on the personality of the user. 50/50."
		Expert 5: "I think it will depend from person to person, because some might have other preferences and others might want to have it in the app."
3		**Expert 1:** "The challenge will be, it is a broad spectrum, I look at myself, say I use, this Samsung watch. It has options for stress management. So it can monitor my pulse and everything. So it can tell me when I am stressed. But I have not opted to use that feature. Because I am very self-aware., and I know when I am under pressure and feeling some type of stress, but for students who maybe have suffered from stress they would want to intentionally monitor how they are doing to ensure they are on the right path and to also take necessary measures if they feel they are under stress. So, it varies but more likely for the students who are aware that they suffer from stress and experience some levels of anxiety and want to actually deal with it and address it."
		Expert 2: "Self-tracking, ah, I will answer that in such a way that, what are you tracking the students for? What exactly is the purpose of the tracking, Yeah, I think it will be helpful because, to give statistics and analytics, on their progress."
		Expert 3: "I think that will be definitely necessary for, I think if we evaluate behavior and see an improvement, it also boosts our confidence, and with boasting of our confidence, our behaviors improve. Yeah, definitely you need to have some kind of self-tracking and I think that kind of self-tracking will be 'do you feel less stressful? Do you feel a bit more relaxed? And then it tracks whether you have any improvement, monitoring."
	Can self-tracking features on mHealth apps help students manage their stress? **(Self-Tracking)** or **(Self – Monitoring)**	**Expert 4:** "Yes, definitely we can only manage our stress if we know the precursors, the events that make us stressful, the thinking that make us stressful, the people

		that make us stressful, so they are stress triggers, and people are not always awakened or aware of the stress triggers. So this kind of apps can make them be aware and make connections and they can make adjustment. Psychology people call it self- monitoring. You usually do it in a journal. You can have an online journal, which makes it more available. You don't have to carry a book with you." **Expert 5:** "Self-tracking is a way. Sure it will, it will motivate them to know how far they have gone in steps in terms of managing their stress."
4	What level of competition do you think will be appropriate to attract students to use the mHealth apps for stress management? **(Social Competition)**	**Expert 1:** "I look at stress management; it is more of health concern. So engagement is more likely based on a student's desire to improve themselves not necessarily to be better than anyone else. So for me gamification would necessarily, I mean if it is not competition against other people, which is something of challenging one's self whereby they progress over time the app maybe tell them that you have gone this far and give you reward that will encourage . But if it is comparative to say 'Ah you are doing better than Steven or whoever', as long as it is internal if it is competition and challenging them, its fine but competition that involves others, not in terms of health." **Expert 2:** "Yeah, I think so because, people have mobile phones and there are many apps they have downloaded on their phones. You need to have something that kind of interests them to want to always open that app and use it. So healthy competitions are good. I can give a typical example of what Facebook is doing these days. There is this app so many people are playing, and for people that are not regular Facebook users, you can now see them online because they are playing that game; because it is nice, they challenge their friends. I think it will be very useful. At least if people can see that my colleague and other friends are progressing with this, it kind of encourages them to use the app. I will be up for it as well."

		Expert 3: "Hmmm, I think any kind of competition, it depends on the type , always a motivator but I think sometimes, if you do the competition , it needs to be very confidential because people don't like to talk whether we like it or not. We don't like to admit. Although everybody is struggling, we don't like to admit it. So there needs to be some confidentiality, and then you can also have some kind of competition with yourself. And that is a very fundamental thing in health. We shouldn't, because the problem starts when we start competing with other people. Yes exactly." **Expert 4:** "It is a strategy used for children. If you put any game, which makes it competitive, I do think it will help; just that some people don't like competitive elements because they always lose. The second thing is competitive. It triggers their low self-esteem, or they're-not-good-enough complex. Other people thrive on competition. So for them it will be a motivating factor. For kids it will work. Kids are very competitive." **Expert 5:** "I think it would; because any competition, any sort of competition triggers an individual's attention, the more attracted they are and the value it brings to them. So it will definitely attract them."
5	Will students share their mental health status anonymously; encourage the use of mHealth apps for stress management? **(Anonymity)**	**Expert 1:** "With information sharing, in Namibia, context of Namibia, people do not trust confidentiality of applications just yet. It doesn't matter, if you tell them about security, etc. They tend not to be so trusting of these applications. That is if it is online. If I send it from my phone, it is going to be known that it is me. That will be the mentality of the average student here. Would they be willing to share information anonymously? Again why would they want to, if they are getting treated or getting results from it? If they are told this information is going to a doctor, this doctor is going to be helping you in some kind of way, psychiatrist, if they are getting some benefits from sharing the information, then they would be. Even then they would decide if they are willing to

| | | want to share anonymously or use it with their own names."

Expert2: "Yes, I think so when it comes to health apps. Like I said earlier, health related issues are personal. If I am to share my experiences or whatever, at least some form of anonymity feels safe for me; secured and private."

Expert 3: "Yes, I think so. We can look at last year when we had our mental health evening. Hmmm I don't know if you attended the evening. I think , we had an evening where people shared their mental health challenges; whether depression or whatever or whether they have anxiety and I was very surprised because I always thought people will be very reserved about it and don't want to talk about it. But we had a room filled with students and the venue was packed. So it shows that everyone is dealing with it and they are open to sharing it and maybe firstly anonymously. A platform will be perfect. I think it is also a good thing and it makes people aware that I am not the only one who is struggling with this. There are other people too."

Expert 4: "I believe the idea of denial. People often don't stop, and reflect but if you are encouraged to stop and think 'that is this how I am feeling today'. Then you might develop that awareness. Actually, I have been stressed for a week in a row now. Maybe I actually have a larger problem than I am even aware of. I find people share more easily when it is anonymous because of the fear of stigma attached. Only anonymous will not work but having a prompt about mental health will work."

Expert 5: "Yeah, it would because sharing is caring. If someone else needs to manage their stress by seeing someone else's status, that person will be actually motivated to manage the stress."

6		Expert 1: "It depends, are they getting rewarded for using the application, or for asking progress in terms of their health. When I say stress app, I usually think of health and it has to be personal gains in terms of health. Having said that if there are rewards, students are enticed by some form of rewards and gratifications, etc., I will say that rewards will work. "
		Expert 2: "I think it will motivate. These days if you see most apps they have some forms of gamification. You earn points or get something free if you use frequently. For example food apps. If you order five (5) times, then the sixth time you order, it is going to be free. I think it is going to help to motivate users and encourage them to use the app."
		Expert 3: "Yes, I think rewards, any kind of reward is encouraging for people to use things. What kind of rewards? I don't know what you mean by rewards. You can also have something like virtual rewards; 15 marks if you have done meditation for a week."
		Expert 4: "Rewards for encouragement for using anything works. If you want people to use the gym more frequently, you give them a rebate for going. It's the same if you want people to use an app. Reward will help them be fit."
	Does reward for using mHealth apps for stress management affect or encourage the use of it? **(Reward)**	Expert 5: "Yes, it will give them a sense of appreciation for what they have accomplished."
7		Expert 1: Yes, goal setting in something they can look at. Something they can work towards, and they get some sense of gratification if they achieve that goal. So that will encourage the use of the app. That will be beneficial to the application.
	Will goal setting change the ways you use mHealth apps to manage stress by students? **(Goal setting)**	Expert 2: "Yes, I think it will motivate them to use it. When it comes to these kinds of apps, it is my wellbeing. So I will want to see my progress. If I am doing well, and what I need to improve or if I set goals and meet them, it makes me feel, it encourages me to do more. It gives me positive feedback that I have done well to manage

		my stress for the last five days or two weeks or so. Yeah, I think it is something to consider."
		Expert 3: "I think, it will definitely motivate them. Goal setting is part of motivation and part of stress management. If you don't have goals, you don't know where you are going. So I will say it is actually a very important requirement. But it shouldn't be you have to set goals. People should be able to have the option that I don't want to set goals and the things with goals is that people always think it is a difficult thing to do , but it isn't. It can be very easy and straight forward. It should be optional."
		Expert 4: "I think it definitely can. Most often the students are quite young which means that their time management skills are not well developed. Their reasoning capacity has not developed so well yet and the younger you want instant gratification than delayed gratification. So you are not going to spend your time as well as you should and this kind of app can help you manage your time and that means you don't have that last minute deadline stress. The more you plan, the less stress you have. Stress as a goal is not good. An example is, today, I was stressed twenty times. By this time next week I want to stress three times. That is not an achievable goal. That is not managing your stress. A better goal will be these: are there things I need to do for stress management, like exercise, eating, socializing? OK, I know that last week, I did not exercise. I only socialized once. I didn't go to church. I want to see if next week if I can increase these activities and behavior linked to stress reduction."
		Expert 5: "It will do perfectly, because we all want to achieve something. When we set goals, that will give us a sense of, just as the competition before, we want to win, they would want to win."
8	Have you found any positive or negative response to	**Expert 1:** "This will have more to do with data. Hmmm men are not so likely want to share freely information

accountability partner features of mHealth apps for stress management by students? **(Monitoring)**	with others. Firstly there will be that disparity between males and females. Females are more relational. So if females use the application, they will be more likely to engage and hold themselves accountable to other people. Men tend to be self-dependent."
	Expert 2: "Yeah, it might work but it depends on the personality types that are using the app because people have different personalities. Some people work well when they are called out to be responsible to account for something. It just depends and I can put it 50/50 chance hmmm, yeah."
	Expert 3: Yes, I think it will work because accountability is a form of support mechanism. It is a very good option you can have. If we see students, when they walk out of the office, we always say, give them certain, I call it homework, kind of thing. I can't solve your problem. You need to do it yourself. So I put some things that they need to do when they come back to me. Then we look at what did they do and if there were challenges. So accountability is like that. Did you do it and why did you not do it? What was your problem and what should we do now? What do we need to change so that it is not a problem for you again?"
	Expert 4: "Yeah, if we are using this thing particularly for a student population that is already being stressed. Some of our stress is related to excessive use of technology. So technology use in itself can be a stressor. For example now with lockdown, people are experiencing Zoom burn out or Zoom fatigue. So for students having to do one more thing on technology can actually be a stressful factor. Provided the user is honest, people generally are because it is not going to your supervisor. So I think it should probably help often with stress management with mental health. Overall, it affects those that are less connected and those who have less of a network. If you are trying to use this app and see that you need an accountability partner but I

		don't have a single friend or family. Then that could be a trigger for more stress. That will be a minority group but we have to remember that. Stress and mental health both have links to poor network, poor connections, and the better your connections are, the less you have stress. It works if you have an accountability partner to call on except if you have an electronic accountability partner. For instance a Bot, who will say "Hello Iani, I noticed you have not been to the gym this week".
		I think that aspect has got a lot of potential. Social networking is a protector. When you are stressed your brain produces adrenalin, and cortisol hormones which are both stress hormones; but when you are with your friend, especially females, your brain produces oxytocin. Oxytocin helps break down stress. Men also produce oxytocin when they are in the company of the people they feel they belong to; social networking if these apps can help seek social company".
		Expert 5: "I think it will work and also No. Some choose to be anonymous. If you can set anonymous partners, that will work. And some are afraid to share their mental status."
9	Do you think that peers or classmates motivate students to use mHealth apps for stress management? **(Social Role)**	**Expert 1: "**I believe yes it could, since there is a lot of peer to peer counseling already among the students themselves. They have that. That will be directly and not through the app. Someone will recommend it through conversation."
		Expert 2: "Personally I don't think so because I speak out of experience. I know me and my classmates. We have stress issues on school work and no one has ever recommended a health app to manage my stress. I don't think so at all. Yeah, I am sure if I have a group I study with and they recommend it, I think it will motivate me. It will definitely do that."

		Expert 3: "Yes, word of mouth is a very a good way. A lot of students that come to my office, it is basically word of mouth, some form of marketing."
		Expert 4: "I think it depends on the student. Some students will absolutely promote that and other students that are low motivators they might just discourage the use of it. Yes, it could encourage or discourage. Stigma, if I am hanging with my friends and the app and my app is set to 3 o' clock notification as my reminder and my friend notice I am using a mental health app. Oh you are using a mental health app!!! It might stigmatize me to my friends. 'You have got mental health issues'. I will also try to make the app neutral, so people don't realize it is a mental health app when they use it. It is short time thinking. In the long term, when we break the mental health stigma, then every NUST student should have a mental health app on their phone. Then it won't be a stigma. Maybe call it academic support app. You can look at stress, anxiety for the long term and what the apps show is the issue."
		Expert 5: "Yes, because they have relationships."
10	Does earning points on a leader board impact student use of a mHealth app for health condition improvement? **(LeaderBoard)(Gaming)**	**Expert 1:** "I won't recommend a leader board to begin with, because of competition. Again in terms of health, it is a personal thing, and it is not something that you compare with others."
		Expert 2: "Because this is a health-related app, I wouldn't find it to be useful. This is not a game, and these are people's lives. I believe when it comes to health, at the most part it ought to be private. I don't think leaderboards is a wise decision."
		Expert 3: "I don't think it will necessarily be a big motivator. I think there are other things that are a bit more important. I don't think that will motivate. It depends on the person's personality. Maybe a small percentage of people in the world are motivated by how

		much points they earn or where I am or how well I do. I think a huge population is not like that. They will not care whether they are first or second. Their aim is more about getting this stress management and getting some results and feeling better."
		Expert 4: "Definitely, when you were a kid, little stars. When you were kids, you wanted t-shirts. When you are adults, you want the same; you want recognition."
		Expert 5: "Not really, because some that have stress issues, may even get worse; add more stress for them."
11	Does participating in a team effort to address mental health with mHealth apps among NUST students encourage or discourage your participation? **(Cooperation)**	**Expert 1:** "A team effort has the challenge of confidentiality. People are willing to forfeit their confidentiality. Then they can benefit from team effort, but not many students will want a group of people to be aware of their situation."
		Expert 2: "Yeah, I think it does encourage. Team effort means people share their different experiences, and from that, someone can be motivated through someone's testimonies. So I think, yeah it does encourage participation."
		Expert 3: "Yes, definitely it is a broad situation."
		Expert 4: "I will love to say yes because yeah we do have a hood mentality; that is group setups. That is why group therapy is always more effective than individual therapy. Also with group outcomes, you have peer pressure to use it, peer pressure to work on yourself, peer pressure to call yourself out. Group therapy is way more effective because individual therapy don't have to take accountability, but if you are in a small group of peers, that the entire group don't like talking about mental health that is not something that should be discussed, then the group dynamic will rather be discouraging . Most cases, in my experience of

		working with NUST students centre, NUST is mental health advanced. They are aware. They promote mental health. So they will encourage its use. Maybe there are other universities that will discourage the use, perception of mental health and apps about mental health. NUST will be very supportive of such an app." **Expert 5:** "Yes it would because they will have the feeling of not being the only one once they realize some other people are fighting for these issues and they are involved in a team that would encourage them."
12	Does the interface of an mHealth app for mental health motivate students to use it for managing their stressful conditions? **(Interactive)**	**Expert 1:** "That will be based on user experience. And the interface if designed properly shouldn't be an issue, but it should motivate students not necessarily, but it shouldn't be a concern. A student should just embrace it without thinking twice. A badly designed interface would make a student pick up the app and start wondering about the interface. Then ahead of the interface is the user experience, because if the student picked up the app because they are stressed, the last thing you want them to need is an interface that gives them more stress, and you want something that is easy to use." **Expert 2:** "Definitely, the UI/UX, user interface and user experience literally contribute. It has been simple, straightforward; not so many actions or clicks, because it is trying to minimize my stress. So, I cannot be forced to read a lot of things or tick a lot of boxes, when you want to tell me, when you replace a lot of check boxes with voice, like just record your progress. It is something that is a lot of difference. That is the way I see it and from my experience." **Expert 3:** "Yes, it should be user friendly, because you don't want to struggle, for understanding an app." **Expert 4:** "I think all interfaces do, regardless what you do. If, it is not user friendly, if it is difficult to understand, people will not use it."

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		Expert 5: "Yes, the interface would. It would definitely, and because users can instantly connect to the contents through the interface once the user is connected through the interface, it is a trigger to find out more."
13		**Expert 1:** Yes, I think that will help in terms of it being similar to an alarm that reminds you to take your medicine, or something. So it will work. It will be beneficial to students.
		Expert 2: "I will say yes. When it comes to apps like this, it is about my health. I will need to define my progress. When I have this kind of engagement, it also motivates me to continue using the app, Yeah, it should help."
		Expert 3: "Yes, I think it will work and one of the things, usually in the evening will a little bit more vulnerable. I don't know if you talk to people, you should never make decisions in the evening because sometimes you are more emotional, vulnerable. Why that is, I cannot say. Yeah, usually people experience stress in the evenings. Sometimes that is why we struggle to go to sleep. So at such times, and it should also be a time when people are a little bit quiet. Like early in the mornings, you have to go to work at 8 a.m. That time you are just waking up and you have a half hour sleep down but then in the evenings later."
	Does time-based or periodic schedule affect students' engagement of mHealth apps for stress management? **(Periodic)/ On-Demand**	**Expert 4:** "It is my first approach in therapy. It is for people to monitor specific times. So I get them to use their phones as alarm. When it is one ' o clock, let me reflect. Most of the apps they use, in the evening they will check in. So I think it helps you because we go off and we forget to check our mood. These things work based on their consistent use. Timer can work with consistency. I have an app to do mindfulness exercise." **Expert 5:** "Yeah, that because that would create a new habit in the students."

14		**Expert 1:** "I believe so. The more aware they are, the less ignorant they get; the more they are likely to address it, and if you don't know, you have a challenge."
		Expert 2: "I think it will. It makes sense. I think it will because these are facts. At least if it gives some type of percentage and timeline to say that these people have been, some kind of study and research that back that fact, I think It will certainly encourage them to use such app."
		Expert 3: "Yeah, hmmm. People feel they are part of a group thing. It is again about sharing is caring. If you have facts saying it is normal to stress about exam, then people don't feel alone and abnormal because I have this stress. If you say this is the percentage of people that have stress and you share the experience, then they will say it is fine. I can use this app to make me feel a little better."
		Expert 4: "First it will make me. Some of the apps I use, I will look at the developers and I see some of the biggest psychologists and names out there on the team, definitely I will use the app. Some people need a little bit of convincing. They don't believe in mental health yet, if you can use the apps and facts to get buying."
	Will logic or appropriate facts sharing about students' stress condition motivate them to use mHealth apps for stress management? **(Authority)**	**Expert 5:** "Yeah, because they will want to use something that is proven to work."
15	Will customization or personalization be effective in encouraging NUST students to use mHealth apps for stress management? **(Personalization)**	**Expert 1:** "Customization in terms of, if you look at customizability, in terms of notification, and scheduling, that could be beneficial. If it is in terms of interface, and all that customization, not at all. In terms of additional features, customization might be there necessarily as long as they are made aware to know they have the features available. Should students need to access something like meditation or music, they will know the way to access it not necessarily. Of course you can have interface designed to have your prominent features

		easily available, say on icons on the main interface whereas other not so used features are hidden away in the menu or something like that."
		Expert 2: "Yeah, as I think of it, I think it will work. People like apps that understand them, understand their behavior, their way of doing things. I will give the example of Facebook. People that you follow or interact with influence the ads you see on your timeline. Yeah, I think it is something that can add some value."
		Expert 3: "Yeah, because what works for one person does not work for another, some people will use meditation, other people will use music, and other people will use exercise. So I think that is one of the important things. It is to be able to customize your app OK, the way it works for you."
		Expert 4: "Again any app that is personalized will speak to you but I think for mental health app that is personalized for me is the one that looks at my history and I can say look Iani, in the last week you have not done this thing which is on your priority list for your mental health. The more personal it can be, the more it speaks to my personal habits, and the more useful it will be, than the generalized one."
		Expert 5: "Yeah, because if there is a certain standard that comes with the application, some will feel like they are left out, but if there is personalization that speaks to their personality, it will definitely help."
16	Does setting expectations on the app motivate the use of mHealth apps for stress management? **(Expectation, Commitment and Consistency)**	**Expert 1:** "Setting expectations can discourage students from making use of it. Should you not meet those expectations, there is a huge discouragement, and while some people might achieve the expectations in a week, others might require a month. Tto them, a month is good progress, but they shouldn't feel disappointed because they didn't do it in a week."

| | | | **Expert 2:** "Yes, definitely. The first reason I will look for in such an app, is that I will expect some results. So I will say yes."

Expert 3: "No, to a certain extent. You have to be careful with people with expectation. For one person, it will take a week for him to be OK. For another, it also depends on what your stress is and what your mental health is, People that struggle with depression sometimes take six (6) months. Others take two to four years to really get to the point where they are out of it or to the point where they are satisfied with their mental health. It is difficult with patients because you work with individuals. I don't think it will work, because with expectations come guilt and guilt can be a negative thing and for me, you have to be careful when you put people into a situation where they do not reach the expectation and they think 'there is something wrong with me'."

Expert 4: "If the expectation can be scientific based, for example for mindfulness, it takes ten to twenty minutes mindfulness practice for it to have impact on your mental health; your app could say our expectation this week is that last week you did three (3) minutes, let's see if you can get to five (5)minutes. It is like a goal but instead, each week we are upping it. So we have expectation in terms of efficacy, because your goals might not be linked to the things that make the treatment work. With mental health, we use exercise to deal with stress. You need to do at least thirty (30) minutes of cardio to have an impact. If you going to walk around for five (5) minutes, that is going to be a goal but it is not going to be linked to an outcome that is going to give you the result you want for your mental health. It has to be linked to the desired outcome."

Expert 5: "Yes because of the capability that humans have to connect visually, or to feel something through visual presentation." |

17		**Expert 1:** "I will say yes, in the sense that not necessarily that they encourage the students, but it is uniform with the way students interact with one another i.e. emojis, emoticons. If there is a level of familiarity, then the students are not over thinking. That is something that is foreign."
		Expert 2: "Definitely, emoticons are now our new way of communicating. So rather than putting a lot of words describing how my day is on whatever else I have interacted with on the app, when you put emoticons, a summary of feedback, then it is very precise on points and easy to relate to. I will say Yes."
		Expert 3: "Yeah, because, pictures are always easier for people to relate with."
		Expert 4: "Yes it definitely works for other behaviors we want to improve. For example in Australia, for over speeding behavior, they have emoticons. So if you are exceeding the speed limit, you get a sad face. But if you stick within the limit you get a happy face. They found that it is more effective than ticketing or punishing or everything at all. Considering the driving in Namibia and we have got the biggest fatalities, we need the emoticon system. If it works on an emotional level beyond logic level of individuals."
	Are emoticons or persuasive images likely to encourage use of mHealth apps for stress management by students? **(Self-monitoring) (emojis)**	**Expert 5:** "Not really, because expectation could stress them because it would put that thought of I don't deliver, I won't have this and that might stress them a little bit."
18	Does positive or negative enforcement of NUST students' behaviors by mHealth apps for stress management encourage use? **(Positive reinforcement)**	**Expert1:** "I believe there is some level of balance. Make them aware of the potential consequences of not managing your stress. The focus primarily, especially if someone is suffering from stress, to be on positive re-enforcement. Positive reinforcement will like be build up, negative reinforcement, most people know the consequences of things. Even when negative reinforcement comes, that is why some boxes will have red boxes, will have the photos of these people with lungs that look horrible but people will go in and buy that

very same box but if you tell someone, your grand kids will like to play with you some day, that is a different type of motivation to put out. That is just positive reinforcement. It will be useful."

Expert 2: "It will demotivate because, as long as an app calls me out that I have done something wrong, I won't feel good about it. And should be cautious in the sense that it is encouraging, 80 % it is encouraging for me. So that I continuously trust that it is going to help me. If I do something wrong, instead of the app saying this is the consequence, I will literally delete the app. First of all, it is not my mother and I will feel like it is now judging me. I don't want to find that in an application. Those are my thoughts on that."

Expert 3: "Yeah. I think people don't always think about the consequences of these. If you don't feel well, you don't perform well. Positive or negative, positive is always good but negative also motivates people. Definitely I also think that it is very important because people then think about consequences, of things. It doesn't necessarily have to be fear but realistic, realism. You know the situation you are in. If you don't deal with this stress, you will probably not be able to finish your study. You need to be realistic about your outcome. For instance, a lot of people don't realize that drug use can lead to mental health problems, challenges, depression and things like that and only when you see that, but they don't always show that to students. You can use drugs but it can lead to mental health problems."

Expert 4: "Yes. Psychologically, we believe more in positive reinforcement than negative enforcement. There is also a showing that long term you become blind to negative reinforcement. So it depends. I have not exercised for a week and so this app, is to help me reach my goal. A sad emoticon face can either help me feel guilty and then I will go do it or just make me feel guilty and stop using the app. We have this expression in

		psychology called ''catch them doing well''. We want to reward the behaviors we want, and to punish the behavior we don't want. So maybe look at the exercise. If I haven't exercised for a week, instead of showing sad emoticon, you can show my statistics dropping and the moment or the seconds I go to the gym again, I must get happy emoticon, and reward the behavior we want rather than negative."
		Expert 5: "Yes, it will motivate them if it is connected to the goals."
19	Do you think students will use mHealth stress management apps that give students recommendations, suggestions or advice to motivate use? **(Suggestions and Kairos)**	**Expert 1:** "I believe so, Yes. When it comes to stress, and stress management, students might not be as informed or aware. Mental health is still something that we are still new to, mental health education; it is a means to an end, giving the notification and etc. that give general good ideas, will be beneficial. Perhaps those notifications will be great. Let's say someone opens the application, comes in as a pop up. They know they are looking for something like that. Not necessarily to see a notification icon and you mentioned customization. That will be the sort of thing somebody will opt into."
		Expert 2: "Yes, it will. Suggestion and advice are welcome because it gives me some kind of perspectives. It will at least point me in the right direction."
		Expert 3: "Yes, but if it should be from experts, and something that I always say. I want to hear from people that have gone through these things. For instance if people have financial problems, they don't want to hear from people who have gone through life easy. They want to hear from people who have gone through financial problems and know what it feels and someone who has dealt with depression. And it is always easier to hear from someone who has dealt with this issue; someone who has experienced it or from an expert.

		Expert 4: "I think it will be more effective that way than if you don't. If it is just an app it is diagnostic, but it doesn't tell you what I do. It is not going to be as useful."
		Expert 5: "Yes, for instance, personalization, if the recommendation will speak to individual personality."
20	Do you believe mHealth apps for stress management that engage in some simulation or role-playing activities will be popular? **(Simulations) (Role-playing)**	**Expert 1:** "It will not suspect that will be something that will be popular among students off the top of my head. It will be an area that I will say maybe more study can be done, but role playing might be something that interests students once off the first or the second time, and they do it; but to invite them continually, role play may not be something they will be up for."
		Expert 2: "I think so because in my experience it is easier. When you are role playing, it is like being in a virtual world, you make decisions and it will have real world effect. They will be popular."
		Expert 3: "Yes, a lot of times, our stress become a challenge for us. We are unable to say no. We don't have the ability to be assertive. So a role playing activity will be how to be assertive in situation; maybe with a friend. Hmm. Then if you are able to be assertive, your stress then will decline during the process. That will be something that will definitely be good. The more practical a mental health app, the more useful it is. The more practical, the more tangible, and the better it gets."
		Expert 4: "I want one. It will work. A lot of psychological training tends to change your behavior and often we feel ashamed to practise that with other people. So if you can have a simulation or role play with a person on the phone, it takes that guilt away. You can fail without the guilt or criticism; you don't want to be criticized by an app."

		Expert 5: "Yes, it would, because they would be active, and the more active they are it will make them feel they are working towards a goal."
21		**Expert 1:** "If we consider stress, and how students are experience stress and whatever, if there were some association with that and their academics, their results and it will say this is link to this and this is link to this, then that will be something that will really encourage them , from the students perspective, let say they have their grades and could assess their grades how they are doing mentally according to the tracking from the application , then they will be able to see if there is some correlations, and I believe that a healthier mind, would result in better grades, etc. and that would encourage students to actually make use of that application, I can monitor my health for half a semester and I look at my test and my stress level go up , then student will be more intentional. " **Expert 2: "** They look concise and feels it has touched all aspect of the mHealth app, The type of marketing approach that should be embrace when creating such app- I will say this - it will be wise to relate to students in the adverts or in the video adverts that you are going to put out there. So that you know, when a student passes by the see a billboard, or a video when a friend has shared the video - they can be like yeah man, I am in that space. Every time people relate to a kind of problem and a solution, it is easier for them to go to the playstore or app store. And should download that. People use things that they can relate to." **Expert 3:** "Kind of a Feedback kind of thing, it is a thing people kind of be able to share their experiences, with other people and other people learning from you, even if you are for instance say I have tried the simulation, I have tried the meditation , it worked for me , some kind of feedback , if there is a kind of statistic part of the app, but what is nice about that is that experts can use it, we share with others, this a stress situation and how I did I deal with it and you have some kind of statistics around

		it, then experts can go and say , this for me , let's say 20 students say this meditation for me really helped me . then it also part of the feedback, I will try it with my other groups and recommend others, some of data collection." **Expert 4:** "I think recommendations to other apps, if the app can be sort of a gap analysis, of your time is management isn't great, or we notice your financial intelligence is not good, try this app or maybe you go see the ministry of finance, or referral to the student services, for counselling little stars for reward system , you can also link that if you want to run through NUST for reward, maybe if you are actively using the app and the app shows you are making progress, maybe you get 5% discount in your student fees. If I know in my next exam I can get 5% extra because I am using this app to manage my mental health, I will be much likely to use the app. If you think from NUST perspective they have vested interest in having something like this because the more anxious and stressed the students are the least likely they are going to achieve or go to their classes, you are going to see various students commitment and participation." **Expert 5:** "If AI can be incorporated, emojis, AI can be incorporated to output a voice, for instance alarm and all of that. It will feel like you are being taught, instead of just reading the words."

Table 5.3: Criteria for Adding and Removing Components

Number of Participants Selecting an as Element Relevant	Add to the List of Relevant Elements
0	No
1	No
2	No
3	Yes
4	Yes

5	Yes

It was resolved that when eight (8) or more participants regarded an element relevant, it should be added to the list - the Awareness element from section A (piloting   questions).The elements listed below are those identified by the students as relevant.

5.2.6. FINDINGS

The findings are presented in Table 5.4. The first column describes the elements, the second column states whether it was added or not. The last column lists the participants that accepted the elements.

Table 5.4: Criteria for Including and Excluding Elements of Persuasive Strategy.

Number	Elements of Persuasive Strategies for mHealth Apps for Stress Management	Included	Accepted/Recommended By
1	Mindfulness / Awareness.	Yes	2,3, 4, 5
2	Reminders or Tunneling.	Yes	1,2,3,4,5
3	Self-Tracking or Self – Monitoring.	Yes	1,2,3,4,5
4	Social Competition.	Yes	2,3,4,5
5	Anonymity.	Yes	2,3,4,5
6	Reward.	Yes	1,2,3,4,5
7	Goal Setting.	Yes	1,2,3,4,5
8	Monitoring.	Yes	3,4,5
9	Social Role.	Yes	1,2,3,4,5
10	Leaderboard/Gaming.	No	4
11	Cooperation.	Yes	1,2,3,4,5
12	Interactive.	Yes	1,2,3,4,5
13	Periodic / On-Demand.	Yes	1,2,3,4,5
14	Authority.	Yes	1,2,3,4,5
15	Personalization.	Yes	1,2,3,4,5
16	Expectation, Commitment and Consistency.	Yes	2,4,5
17	Self-monitoring, Emojis.	Yes	1,2,3,4,5
18	Positive Reinforcement	Yes	1,3,4,5
19	Suggestions and Kairos.	Yes	1,2,3,4,5
20	Simulations or Role- playing.	Yes	2,3,4,5
21	Artificial Intelligence Integration.	Yes	Recommended
22	Solution Recommender/ Referrals.	Yes	Recommended
23	Data Analytics/ Statistics.	Yes	Recommended
24	Biofeedback.	Yes	Recommended

The experts were presented with twenty-two (22) elements of persuasive strategies as selected by NUST students to evaluate and validate. Eventually, a total of twenty-four (24) elements of persuasive strategies were validated by the experts. Twenty (20) were from the list prevented to them, while the experts recommended four (4) additional elements.

Mindfulness	Reminders or Tunnelling	Self-Tracking or Self – Monitoring	Social competition
Anonymity	Reward	Goal setting	Monitoring
Social Role	Periodic / On-Demand	Cooperation	Personalization
Authority	Interactive	Expectation, Commitment and	Self-monitoring, Emojis
Positive reinforcement	Biofeedback	Suggestions and Kairos	Awareness
Data Analytics/ Statistics	Solution Recommender / Referrals	Artificial Intelligence Integration	Simulations or Role- playing

Figure 5.2. **Validated Elements of Persuasive Strategies to Facilitate the Use of Mhealth Apps for Stress Management by NUST Students.**
Individual uses or a combination of these elements of persuasive strategies in an existing or new mHealth apps for stress management will increase the chances of use by NUST students as described and/or reviewed by experts in mental health and mobile health applications practice.

The proceeding list highlights the different validated elements of persuasive strategies displayed in figure 5.2 above.

5.2.1. Mindfulness – It is creating user awareness of their behavior in order to facilitate change. It is paying attention on purpose, in the present moment, and non-judgmentally.

5.2.2. Reminders or **Tunneling -** Take users through redefined steps for accomplishing the target behavior and guide them from distracting actions.

5.2.3. Self-Tracking or **Self – Monitoring -** It is paying attention in a particular way; on purpose, in the present moment, and non-judgmentally

5.2.4. Social Competition – Provides the means for a user to compete with others.
.
5.2.5. Anonymity - The opportunity to provide privacy or faceless

5.2.6. Reward/Positive reinforcement - Offers virtual rewards to users for performing the target behavior.

5.2.7. Goal Setting - Allows users to set behavioral goals. This is desirable when aligned with other life or activity goals aligned with reducing stress. Examples are exercise or meditation.

5.2.8. Monitoring - Allow one party to monitor or check on the behavior of another party.

5.2.9. Social Role - Social encouragement, feedback, etc.

5.2.10. Co-operation - A computing technology that is visually attractive to target users is likely to be more persuasive as well.

5.2.11. Interactive - The use of computing technology that is visually attractive to target NUST students is likely to be more persuasive as well.

5.2.12. Periodic / On-demand - Ability to select various time intervals for any of the preferred activity types. The objective of this recommendation is whether on-demand triggers for mHealth apps for stress management will be suitable.

5.2.13. Authority - Credible sources present arguments in favor of the behavior.

5.2.14 Personalization - Offer personalized contents and services to users. Contents are tailored based on a user's need.

5.2.15. Expectation, Commitment and Consistency - If individuals have decided to implement a goal or commitment, they are likely to pledge their commitment to the idea or objective as being like their personality. Even if the initial motive is removed, individuals are likely to continue with this obligation.

5.2.16. Self-monitoring, emotion- Affordance Playfulness, Emotions, humor, for emotions.

5.2.17. Positive reinforcement - Offers virtual rewards to users for performing the target behavior, only positive reinforcement is desirable.

5.2.18. Suggestions and Kairos – This element provides suggestions or recommendation for users to help manage anxiety or stress conditions.

5.2.19. Simulations or Role- playing - This entails the use of objective of this question is to know whether allowing users to perform behaviour in simulated situation will motivate them to use mHealth apps for stress management.

5.2.20. Artificial Intelligence Integration – This persuasive element involves the use of artificial intelligence to learn the mood or lifestyle of the students or owner of the smart phone, with the aim to detect stress and recommend a mHealth app for stress management when appropriate.

5.2.21. Solution Recommender/ Referrals - Referral elements of persuasive strategies will motivate an intervention for the student beyond diagnosis. It will also enhance the adoption of mHealth apps for stress management by mental health professionals as a tool for their clients to support in-person care.

5.2.22. Data Analytics/ Statistics – This element will provide data or information for mental health practitioners and mhealth apps for stress management developers to know the necessary interventions to focus on.

5.2.23. Awareness - It is creating user awareness of their behavior in order to facilitate change as well as the marketing of mHealth apps for stress management. This is creating awareness for the existence of multiple options of mHealth apps for stress management.

5.2.24. Biofeedback – This persuasive element detects physiological and psychological changes and triggers the engagement of mHealth apps for stress management.

5.3. SUMMARY

The purpose of chapter 5 was to present the developed and validated recommendations and guidelines by experts as well as the persuasive strategies for mHealth apps for stress management.

CHAPTER SIX

CONCLUSIONS, RECOMMENDATIONS AND FUTURE WORK

6.1. INTRODUCTION

This chapter presents the summary, recommendations and conclusion of the study. It also states the aims and objectives and how they were met.

6.2. REFLECTIONS ON THE RESEARCH QUESTIONS AND RESEARCH OBJECTIVES

The first research question in chapter 1 (section 1.4) was:

- **What are the elements of persuasive strategies in mHealth applications to support stress in the current literature?**

The first research question aided the first objective in chapter 1 (Section 1.5):

- **To investigate the elements of persuasive strategies in mHealth applications for stress management in the current literature.**

The first research question and objective were addressed in chapter 3.

The second and third research questions in chapter 1 (section 1.4) were:

- **What are the elements of persuasive strategies to facilitate the use of mobile applications relevant to support stress management among university students in Namibia, as determined by NUST students?**
- **What guidelines or recommendations are required to be incorporated in the development of mHealth applications for stress management to facilitate use by university students in Namibia?**

The second research question addressed the second objective in chapter 1 (Section 1.5):

- **To investigate the elements of persuasive strategies to facilitate the use of mHealth applications relevant to support stress management among university students in Namibia, as determined by NUST students.**

- **To develop guidelines and recommendations capable of persuading students to use mHealth for stress management and instructional to developers and designers of mHealth app for stress management.**

The second and third research questions and objectives were addressed in chapter 4.

The fourth research question in chapter 1 (section 1.4) was:

- **What elements of persuasive strategies were found to be relevant to mHealth applications for stress management among university students in Namibia as determined by professionals in mHealth applications development practice?**

The fourth research question aided the second objective in chapter 1 (Section 1.5):

- **To validate the elements of persuasive strategies in mHealth applications relevant to support stress management among university students in Namibia as determined by professionals in mHealth practice.**

The fourth research question and objective were addressed in chapter 5.

6.3. THE USE OF DESIGN SCIENCE RESEARCH IN THE STUDY

The application of Design Science Research strategy was utilized in this study with the researcher adopting the interpretivsim philosophy. DSR is fundamentally a problem solving paradigm and it is relevant to behavioral science problems of Information Systems with capacity to help improve existing artifacts (Hevner et al., 2004; Gregor & Hevner, 2013).

The DSR provided the needed strategy to help create guidelines and recommendations for elements of persuasive strategies to facilitate the use of mHealth apps for stress management by NUST students.

Guideline 1: Design as an Artifact - The study identified the elements of persuasive strategies in mHealth applications for stress management in the current literature.

Guideline2: Problem Relevance - The problem identified in this study referred to the elements of persuasive strategies to facilitate the use of mHealth applications relevant to support stress management among university students in Namibia, as determined by NUST students.

Guideline 3: Design Evaluation - The guidelines and recommendations were refined in three different phases.

Guideline 4: Research Contributions - The development of guidelines and recommendations capable of persuading students to use mHealth apps for stress management and instructional to developers and designers of mHealth app for stress management.

Guideline 5: Research Rigor -. To maintain rigor and validate the elements of persuasive strategies in mHealth applications relevant to support stress management among NUST students and professionals in mHealth apps stress management practice. Interviews were conducted among NUST students and validated with experts.

Guideline 6: Design as a Search Process - Literature reviews were used to identify elements of persuasive strategies to facilitate the use of mHealth apps for stress management among NUST students.

Guideline 7: Communication of Research -. Some of the findings of the study   have been published as conference papers, at workshops and as journal articles.

6.4. EVALUATION OF THE RESEARCH STUDY

It is critical to ensure that the evaluation of a research study is trustworthy. The use of the Design Science Research guidelines in this research was presented in section 6.3. The study aligned with the Oates (2006) evaluation techniques as outlined below:

1. **Credibility:** Multiple data collection techniques were used in the study to identify and validate elements of persuasive strategies. i. e. literature reviews and structured interviews. The researcher and the supervisors reviewed the data collected.

2. **Dependability**: The interviews were recorded and later transcribed. During the interviews, notes were also taken.

3. **Trustworthiness**: Only NUST students; the only designated subjects of the study population were contacted and interviewed.

   The experts involved in the validation of the guidelines were those who were active and had wealth years of experience in the Namibian mental health and mHealth apps for stress apps development space.

4. **Confirmability:** The interviews were used to confirm the findings from the literature. The expert reviews from mental health and mHealth apps professional contributed useful information to the development of the guidelines and recommendation of persuasive strategies to facilitate the use of mHealth apps for stress management by NUST students

5. **Transferability**: The study can be transferred to other universities in Namibia and other parts of Africa with similar settings.

6.5. RESEARCH CONTRIBUTION

6.5.1. PRACTICAL CONTRIBUTION

The novelty of this work was the compilation of the persuasive strategies to facilitate the use of mHealth apps to support stress management for NUST students. The study presented unique components not previously identified in the literature.

6.5.2. THEORETICAL CONTRIBUTION

The initial findings of the study were presented and published on various platforms (virtual conferences and workshops). The study adds to the limited body of persuasive technology in the developing countries context especially Namibia.

6.5.3. LIMITATIONS OF THE STUDY

The study met the objectives of the study, though there were limitations. The study did not evaluate any mHealth apps for stress management, nor was any mHealth app for stress management developed. Again, the study was only limited to NUST and the duration of the researchers' masters study duration.
The reports and documentation were limited to NUST students and experts' feedback.

6.6. FUTURE WORK

Future work will include implementing the persuasive strategies to facilitate the use of mHealth apps to manage stress for NUST students. Another area worthy of future exploration would be investigating the degree of effectiveness and impact of each element of persuasive strategy.

6.7. SUMMARY AND RECOMMENDATIONS

This chapter presented the summary of the findings of the study. Limitations were identified and possibilities of future work discussed.

The importance of a proper stress management approach cannot be overemphasized, especially in an institution expected to serve the fourth industrial revolution. The need to utilize applicable persuasive strategies in existing and new mHealth apps for stress management is urgent and critical.

If added to existing traditional means of addressing health risks among university students and the youth population generally, the findings of this study should help turn the tide against the challenge of stress

and other mental health related conditions in Namibia. Furthermore, professionals in apps development and mental health will also find this study useful in creating apps or solutions for improved outcomes among clients or users in NUST.

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APPENDIX 1

[Informed Consent Form for Namibia University of Science and Technology (NUST) students in Windhoek and who we are invited to participate in this research titled "Developing Persuasive Strategies to facilitate use of mobile health applications for stress management among NUST students."

[Name of Principle Investigator] – Benjamin Akintunde Akinmoyeje
[Name of Organization] - Namibia University of Science and Technology
[Name of Sponsor] - None
[Name of Project and Version] - Developing Persuasive Strategies to facilitate use of mobile health applications for stress management among NUST students

This Informed Consent Form has two parts:
- Information Sheet (to share information about the study with you)
- Certificate of Consent (for signatures if you choose to participate)

You will be given a copy of the full Informed Consent Form

Part I: Information Sheet

Introduction

My name is Benjamin Akintunde Akinmoyeje and I am a Masters student in the Faculty of Computing and Informatics at the Namibia University of Science and Technology conducting research under the supervision of my main supervisor Dr Gloria Iyawa and co-supervisor Dr Suama L Hamunyela. My research is titled "Developing Persuasive Strategies to facilitate use of mobile health applications for stress management among NUST students." The research is aimed at identifying persuasive strategies to facilities the use of mHealth apps for stress management among NUST students. I am going to give you information and invite you to be part of this research. If there is anything that you may want to be elaborated in this consent, you are welcome to ask questions.

Purpose of the research

This study aims to develop persuasive strategies that will facilitate the use of existing mHealth applications to support stress management among university students in Namibia.

Type of Research Intervention

The research will involve your participation in an interview that will take approximately half an hour.

Participant Selection
You are being invited to take part in this research because you are the primary subject of our research and we believe you have knowledge and experience with stressful condition as a NUST

student. This knowledge is critical to the success of understanding persuasive strategies required in mHealth apps for stress management among NUST students.

Voluntary Participation

Your participation in this study is voluntary; you are under no obligation to participate. You may withdraw at any time without prejudice or penalty. By returning the completed questionnaire script it implies consent for participating in the study. To maintain anonymity, please do not write your name on any of the materials. No individual identities will be used in any reports or publications resulting from the study.

Procedures

A.   We are asking you to help us learn more about persuasive strategies required in mHealth apps for stress management. As a NUST student who is exposed to the possible stressful conditions as you go about your routine academic activities, and how you manage your stress conditions is vital to our understanding of the persuasive strategies that will be appealing to you. Hence, we are inviting you to take part in this research project. If you accept, you will be interviewed.

B. In the interview, I will sit down with you at a comfortable place, where we both agree to, preferable on NUST campus. If you do not wish to answer any of the questions during the interview, you may say so and the interviewer will move on to the next question. No one else but the interviewer will be present unless you would like someone else to be there. The information recorded is confidential, and no one else except my main supervisor Dr Gloria Iyawa & co-supervisor Dr Suama L Hamunyela will have access to the information documented during your interview. The entire interview will be recorded on my mobile phone, but no-one will be identified by name on the recording. The completed study will be reported in aggregate. Confidentiality will be maintained, only the researchers will have access to the study data and information. All data collected will be stored in a secure place (locked cabinet) and will be destroyed in three years.

Duration

The research takes place over two months in total. During that time, we will visit you once for the interview and each interview will last for about half an hour each. If there are follow up questions, you are free to contact me and schedule for another meeting.

Risks

If you feel like the question asked is confidential and you can not answer it, you do not have to answer any question or take part in the interview if you don't wish to do so, and that is also fine. You do not have to give us any reason for not responding to any question, or for refusing to take part in the interview.

Benefits

This study will help identify persuasive strategies that will facilitate the use of mHealth for stress management among NUST students This study will equip mobile app developers and those with already existing stress management apps to create or adjust their apps to sufficiently address the stress situation of university students in Namibia, especially from design phase. There are limited studies on developing countries context about persuasive strategies for mHealth for stress management especially in Namibia.

Reimbursements

Please note that there will be no payments, this is entirely a scholar project.

Confidentiality

The data that's to be collected will be protected by the researcher. The data will not be shared with for public view, the data will only be used for the study. The data or findings will only be shared with the supervisors (Dr G Iyawa & Dr Suama L Hamunyela). The interviewees will remain anonymous.

Sharing the Results
The data will be handled with high sense of confidentiality and may only be shared with the members of the research team.

Right to Refuse or Withdraw
If you wish to not participate, you are welcome to turn down the request. You are as well welcome to withdraw at any time after you have reviewed. You can also stop the interview at anytime you wish. You also have a right to review the notes I am going to take during the interview, modification and removal of portions of the notes is allowed.

Who to Contact
If you would like to know the results of this research or you have any questions about the research, please feel free to contact Dr Gloria Iyawa on 0612072760, or myself, (Benjamin Akinmoyeje) on +264 81 6687 407 or through my email address benakin@gmailc.com. Should you have any comments or concerns resulting from your participation in this study, please contact Dr Fungai Bhunu Shava or call her on: +264 61 207 2510

Part II: Certificate of Consent

I have been invited to participate in research about "Developing Persuasive Strategies to facilitate use of mobile health applications for stress management among NUST students." I have read the objectives of the study and I agree to participate. The purpose of this content is to specify the terms of my parturition in the project through being interviewed.

1. I have been given enough information about this project.
2. My participation as an interviewee in this project is voluntary.
3. Participation involves being interviewed by a researcher from NUST and I allow the researcher to take notes and record with their mobile phone. And if I do not want to talk anymore, I can withdraw at any time I wish.
4. I have been given full guarantee that I will not be identified by name.

(This section is mandatory)
I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have asked, have been answered to my satisfaction. I consent voluntarily to be a participant in this study

Print Name of Participant_____
Signature of Participant _____
Date _____
              Day/month/year

If illiterate [1]

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent

---

[1] A literate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb print as well.

freely.

Print name of witness_____   Thumb print of participant

Signature of witness   _____

Date _____
         Day/month/year

Statement by the researcher/person taking consent

1.   I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

2.   I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

3.   A copy of this ICF has been provided to the participant.

Print Name of Researcher/person taking the consent   _Benjamin A Akinmoyeje_

Signature of Researcher /person taking the consent_____

Date ___22/April/2020_____
              Day/month/year

APPENDIX 2

FACULTY RESEARCH ETHICS COMMITTEE (F-REC)

DECISION/FEEDBACK ON RESEARCH PROPOSAL

Dear Mr: Benjamin Akinmoyeje

Research Topic: Developing persuasive strategies to facilitate the use of mobile health applications for stress management among NUST students

Supervisor (if applicable): Dr Gloria Iyawa

Qualification registered for (if applicable): MASTER OF INFORMATICS

(Reference number of application: FACULTY RESEARCH ETHICS COMMITTEE REGISTRATION NUMBER: F-REC-06/2020)

Re: Ethical screening application No: **F-REC-06/2020**

The Faculty of Computing and Informatics Ethics Screening Committee of the Namibia University of Science and Technology reviewed your application for the above-mentioned research. The research as set out in the application has been:

Approved	X

(indicate with an X, and N/A if not applicable and proceed)

We would like to point out that you, as researcher, are obliged to maintain the ethical integrity of your research, adhere to the ethical guidelines of NUST, and remain within the scope of your research proposal and supporting evidence as submitted to the F-REC. Should any aspect of your research change from the information as presented to the F-REC, which could have an effect on the possibility of harm to any research subject, you are under the obligation to report it immediately to your supervisor or F-REC as applicable in writing. Should there be any uncertainty in this regard, you have to consult with the F-REC.

We wish you success with your research, and trust that it will make a positive contribution to the quest for knowledge at NUST.

Any ethical issues that need to be highlighted?	Why are these issues important?	What must/could be done to minimise the ethical risk?
No	N/A	N/A

Recommendation: The application is approved. Recommendations of FCI/F-REC, communicated to you on the 6th of May 2020, were addressed to the satisfaction of the Chairperson.

Sincerely,

Dr Fungai BHUNU SHAVA

Chair: Faculty Ethics Screening Committee

Tel: +264 61 207 2510

CC: Co supervisor: Dr Suama Hamunyela

APPENDIX 3

NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Faculty of Computing and Informatics

Department of Computer Science

U Storch Street
Private Bag 13060
Windhoek
NAMIBIA

T: +264 81 207 2298
F: +264 81 207 9251
E: dirg@nust.na
W: www.nust.na

The Registrar

Namibia University of Science and Technology

Private Bag 13388

Windhoek

Namibia

04 March 2020

Dear Sir/Madam,

RE: REQUEST FOR PERMISSION TO CARRY OUT INTERVIEW ON PERSUASIVE STRATEGIES AND ELEMENTS TO FACILITATE THE USE OF MHEALTH APPS BY NUST STUDENTS

My name is Benjamin Akinmoyeje with student number 219147531 and I am studying for my MSc in Informatics. My main supervisor is Dr Gloria Iyawa and my co-supervisor is Dr Suama Hamunyela. As part of fulfilling the requirement of my research, I have to conduct a thesis research project.

The proposed topic for my research is: Developing persuasive strategies to facilitate the use of mobile health applications for stress management among NUST students.

The objectives of the study are as follows:

- To investigate the elements of persuasive strategies in mHealth applications for stress management in the current literature.

- To investigate the elements of persuasive strategies to facilitate the use of mHealth applications relevant to support stress management among university students in Namibia, as determined by NUST students.

- To develop guidelines and recommendations which can be used to facilitate use of mHealth application for stress management by NUST students and serve as a guide to developers and designers of mHealth apps for stress management.

- To validate the elements of persuasive strategies in mHealth applications relevant to support stress management among university students in Namibia as determined by professionals in mHealth practice.

The study will be conducted as from May 2020 – June 2020. During this period of the study, it will cover the investigation of persuasive strategies and element to facilitate the use of mhealth applications for stress management among NUST students. This study will help identify persuasive strategies that will facilitate the use of mHealth for stress management among NUST students. This study will equip mobile app developers and those with already existing stress management apps to create or adjust their apps to sufficiently address the stress situation of university students in Namibia, especially from design phase.

I am hereby seeking your approval to conduct my study at NUST where certain activities would be involved as follows:

1. Interview of NUST students.

At the end of the study, I undertake to provide you with the key findings, recommendations and guidelines for persuasive strategies for mHealth apps for stress management among NUST students. The findings from the research will be documented in a report and the presentation on the key findings would be delivered. In order to reassure confidentiality, integrity, and respectful conduct without harm to students, the research will be carried out in ethical manner; the sensitive information and identities of the participants would not be published, any damages or disruption of the studies would be taken with care. Consent will be obtained from the participants of the study, participation will be on voluntary basis and only necessary information would be collected.

A copy of the research proposal is accompanying this for your consideration. Should you require further information, please do not hesitate to contact me on the office number: 2841 or mobile number: 081 668 7407, email address benakin@gmail.com, or my supervisor givawa@nust.na or the Associate Dean of Research, Faculty of Computing and Informatics, Dr Bhunu Shava fbshava@nust.na.

Thank you for your time and considerations in this matter.

Yours sincerely,

Benjamin Akintunde Akinmoyeje

APPENDIX 4

INTERVIEW QUESTIONS

PROJECT TITLE: Developing Persuasive Strategies to Facilitate Use of Mobile Health Applications for Stress Management among NUST Students.

Part A

1. Walk me through a typical day on campus.
2. What is your typical school activities routine?
3. If it was hard or easy, what made it hard or easy?
4. How did you feel about your daily routine?
5. Where do you experience most stress?
6. How do you recognise when you are stressed?
7. What is your biggest struggle that you have in managing your stress?
8. Can you describe the first time you became aware of your stressful condition?
9. Are you aware of any management tools for stressfulness? If yes, please elaborate.
10. What are some of your motivations for wanting to manage your stress conditions?
11. What time of the day do you experience stress or which activities always bring stress?

Part B -   Mobile Phone Use and Persuasive Strategies

1. Do you own a smartphone? If yes, how often do you use your smartphone for stress management?
2. How will regular reminders on your phones encourage you to be mindful of your stress conditions?
3. Would reminders be relevant to facilitate the use of mHealth apps for mental health? Why?
4. How will self-tracking help you manage your stress?
5. What will be the appropriate level of competition and incentives you will be willing to engage in the process of managing your stressful conditions?
6. When sharing your mental health status anonymously, to what extent are you encouraged to share? And why?
7. How does getting rewards for using mHealth apps for stress management affect your use of it?

8. How much will you be willing to pay to be among the few students using mHealth apps for stress management? And how likely are you to sign up for it?
9. In what ways will goal setting change the ways you use mHealth apps to manage stress?
10. How would you respond to an accountability partner facilitating the use of mHealth apps for stress management?
11. What is the effect of having your peers or classmates motivating you to use mHealth apps for stress management?
12. How does earning points on a leader board impact your use of an mHealth app for health condition improvement?
13. In what ways would participating in a team effort to address mental health with mHealth apps among students encourage or discourage your participation?
14. How does your environment influence the use of mHealth apps for stress management?
15. In what ways does the interface of an mHealth apps for mental health motivate you to use it for managing your stressful conditions?
16. How does the time-based or periodic schedule engagement of mHealth apps work for you?
17. How motivated are you to use mHealth apps for stress management if it gives a valid scientific argument or facts about its effectiveness?
18. How motivated are you to use a mHealth app for stress management if you find the profile of the person on the app fits yours?
19. What level of impact will the expectations set on an app affect your decision to use or not use it?
20. How will mHealth apps for stress management with emotional features like humour, joy and sadness faces encourage your use of it?
21. How does positive or negative enforcement of your behaviour by mHealth apps for stress management encourage your use of it for your stress conditions?
22. What do you think of mHealth apps for stress management that gives you recommendations, suggestions or advice motivate your use?
23. Please how will you use mHealth apps for stress management that engage you in some simulation or role-playing activities?

Part C -   Expert Interview Questions

1. Do you believe regular reminders on mHealth apps for stress management will work for students to be mindful of their stress conditions?
2. Do you think reminders will facilitate the use of mHealth apps for mental health by students? Why?

3. Can self-tracking features on mHealth apps help students manage their stress?
4. What level of competition do you think will be appropriate to attract students to use the mHealth apps for stress management?
5. Will students sharing their mental health status anonymously encourage the use of mHealth apps for stress management?
6. Does reward for using mHealth apps for stress management affect or encourage the use of it?
7. Does paid subscription motivate the use of mHealth apps for stress management among students especially with gold status for those paying?
8. Will goal setting change the ways you use mHealth apps to manage stress by students?
9. Have you found any positive or negative response to accountability partner features of mHealth apps for stress management by students?
10. Do you think that peers or classmates motivate students to use mHealth apps for stress management?
11. Does earning points on a leader board impact student use of an mHealth app for health conditions improvement?
12. Does participating in a team effort to address mental health with mHealth apps among NUST students encourage or discourage your participation?
13. Does the environment of use influence students' adoption of mHealth apps for stress management?
14. Does the interface of an mHealth app for mental health motivate to use it for managing their stressful conditions?
15. Does time-based or periodic schedule affect students' engagement of mHealth apps for stress management?
16. Will logic or appropriate facts sharing about students' stress condition motivate them to use mHealth apps for stress management?
17. Will customization or personalization be effective in encouraging NUST students to use mHealth apps for stress management?
18. Does setting expectations on the app motivate the use of mHealth apps for stress management?
19. Will emoticons or persuasive images likely encourage the use of mHealth apps for stress management by students?
20. Does positive or negative enforcement of NUST students' behaviours by mHealth apps for stress management encourage use?
21. Do you think students will use mHealth apps for stress management that give students recommendations, suggestions or advice to motivate use?
22. Do you believe mHealth apps for stress management that engage in some simulation or role playing activities will be popular?