

**EFFECTIVENESS OF SELECTED CBT-BASED SELF-MANAGEMENT
MOBILE APPLICATIONS IN REDUCING DEPRESSION AMONG
UNIVERSITY STUDENTS IN KENYA: A CASE OF SOUTH-EASTERN
KENYA UNIVERSITY IN KITUI COUNTY, KENYA**

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COUNSELING PSYCHOLOGY AND THE HUMANITIES AND SOCIAL
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DECLARATION

I declare that this document and the research that it describes are my original work and that they have not been presented in any other university for academic work.

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DEDICATION

I dedicate this work to my husband Moses Kioko and our children Abigail Ndanu, Annabel Mutheu, and Lemuel Mumo. Their unwavering support, encouragement, and love have been the foundation of my strength throughout this academic journey.

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ABSTRACT

Depression is a highly prevalent mental health concern among university students. The accessibility of smartphones in this population grants a promising opportunity for providing mental health interventions. This study covered five objectives which explored the effectiveness, feasibility, user experiences, and applicability of Cognitive Behavioural Therapy (CBT) based self-management mobile apps in reducing depression symptoms in university students in Kenya. The study used the Cognitive Behavioural Theory and was complemented by the Technology Acceptance Model. The study was a quasi-experimental study of South-Eastern Kenya University (SEKU) in Kitui County. The study used a mixed-methods approach, where quantitative data involved pre-intervention and post-intervention surveys to measure variations in depression levels before and after using self-management mobile apps for a period of eight weeks. The qualitative survey was designed to gather data on participants' user experiences, challenges, and perceptions regarding the self-management apps. The target population was SEKU undergraduate students aged 18-25 years who were proportionally sampled in the six schools within the university, based on the overall population of undergraduate students. The study sample consisted of 107 undergraduate students. The participants were selected using simple random sampling. Participants were randomly grouped into two where one was the mobile app intervention group and the other the control group with no intervention. The groups sample included the SEKU University students who responded to the questionnaires, who met the criteria for depression based on the standardised PHQ-9 screening tool and consented to participate. This study established a high prevalence of depression among SEKU students, with 35.7% reporting moderate depressive symptoms and 5.6% severe symptoms based on initial PHQ-9 scores. CBT-based self-management mobile applications were found to be feasible and acceptable, with 78% of the participants rating the applications as practical mental health tools. Usability of the CBT-based mobile applications feature was found to be helpful by 80% of the participants as it received favourable ratings, with an average score of 8.1 out of 10. The mobile applications significantly reduced depressive symptoms, with PHQ-9 scores decreasing from an average of 15.3 (moderately severe) to 8.9 (mild depression) after the eight-week intervention period. Quantitative data was analysed using statistical methods, including Statistical Package for Social Sciences (SPSS) 20.0. Qualitative data was analysed based on the themes emanating from the research questions. These findings highlight the potential of CBT-based apps to address mental health challenges, including depression, in low-resource settings. The findings prove the possibility of utilising CBT-based self-management mobile applications as potential tools that richly contribute to accessible, culturally relevant, and cost-effective mental health solutions that enhance student well-being and academic performance.

DEFINITION OF TERMS

CBT-based self-management mobile applications (Apps) are digital tools designed using principles from cognitive behavioural therapy to empower people to manage their mental health (Addepally & Purkayastha, 2017). This study used CBT-Based Self-Management Apps to offer self-guided exercises, psycho-education, and coping strategies based on CBT principles to improve their well-being.

Depression - is a common mental health disorder characterised by persistent feelings of sadness, hopelessness, and loss of interest or pleasure in daily activities (Merriam-Webster, n.d.). Symptoms include changes in sleep patterns, appetite, energy levels, concentration, and self-esteem.

Effectiveness - Effectiveness refers to the extent to which an intervention achieves its intended outcomes in real-world settings (Merriam-Webster, n.d.). This study evaluated the effectiveness of a cognitive behavioral therapy-based mobile app in reducing depression symptoms among university students, with results showing a significant decrease in PHQ-9 scores over eight weeks of use.

Feasibility -Feasibility is defined as the practicality and viability of a proposed project or research inquiry, focusing on whether it can be realistically accomplished within given constraints (Oxford University Press, n.d.). In this study, the feasibility of mobile apps for depression management was supported by high user retention rates and positive feedback on usability, suggesting that such interventions can be integrated into routine mental health care with minimal disruption.

Informed Consent - permission from a patient for a medical professional to carry out treatment with a complete understanding of the possible risks and consequences (Oxford University Press, n.d.). In this study, informed consent is used to convey the

participants' eligibility requirements, expectations and information on the extent of their involvement before they voluntarily agree to participate.

Mental Health Care - Mental health care is a holistic and interdisciplinary approach that promotes psychological well-being and addresses mental health conditions through prevention, diagnosis, treatment, and rehabilitation across diverse settings and professional collaborations (World Health Organization [WHO], 2014). In the context of this study, mental health care includes both traditional face-to-face interventions and digital tools such as Cognitive Behavioural Therapy (CBT)-based mobile applications designed to support students in managing depression symptoms.

Mobile Application - A mobile application (app) is a software program designed for smartphones and tablets, available through app stores, that serves various functions, including communication, entertainment, productivity, education, navigation, health, finance, and others (Merriam-Webster, n.d.). CBT-based mobile applications are used in this study as intervention tools to reduce depression symptoms.

Patient Health Questionnaire-9 (PHQ-9) - A 9-item self-report tool used to screen for and assess the severity of depression (Kroenke, Spitzer, & Williams, 2001). In the study, the PHQ-9 was used to measure changes in depressive symptoms before and after app usage to quantify symptom improvement and assess the effectiveness of the apps in real-world settings

Prevalence- Prevalence refers to the proportion of individuals in a population who have a specific condition at a given point or over a specified period (Merriam-Webster, n.d.). In this study, it is the proportion of participants who have depression symptoms as measured by the PHQ-9.

Recruitment – Recruitment for study participation refers to the process of identifying and enlisting potential participants by providing sufficient information to establish their interest and willingness to join the study (Patel, Doku & Tennakoon, 2003). In this study, recruitment is the process of enrolling individuals to participate in research studies, clinical trials, or interventions.

Screening- involves detecting symptoms to identify individuals at risk for a particular condition through brief assessments or surveys (Merriam-Webster, n.d.). This study screened for depression prevalence using the PHQ-9 screening tool.

Self-management – self-management is about finding the self-control and mastery needed to take control of one's work, time, workflow, communication and well-being (Merriam-Webster, n.d.).

Self-management is used in this study as a method, action or process of bettering oneself or overcoming one's problems without the aid of a professional in coping with one's personal or emotional problems, with a specific bias on depression.

Testing - refers to the process of evaluating an intervention, tool, or hypothesis to determine its effectiveness, accuracy, or suitability (Oxford University Press, n.d.).

In this study, testing involved assessing the selected apps as intervention tools to manage depression with respect to their functionality, usability, and impact on users' well-being.

ABBREVIATIONS / ACRONYMS

Apps- Applications

CAB - Central Administration Block

CBT – Cognitive Behavioural Therapy

DIY – Do It Yourself

KUCCPS – Kenya Universities and Colleges Central Placement Service

PHQ-9 - Patient Health Questionnaire-9

SEKU- South-Eastern Kenya University

CHAPTER ONE

INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 Introduction

Depression is a significant global mental health concern affecting university students excessively due to academic, social, and financial pressures (Firth et al., 2017). In low-resource settings like Kenya, where access to traditional face-to-face counselling services is limited, there is an urgent need for innovative, accessible mental health interventions to supplement and enhance existing mental health frameworks. This study investigates the effectiveness of Cognitive Behavioural Therapy (CBT)-based self-management mobile applications in reducing depressive symptoms among South-Eastern Kenya University (SEKU) students.

This chapter introduces the study by providing its background, context, objectives, and significance. It begins with an overview of the prevalence of depression among university students globally and locally, emphasising the unique challenges faced by SEKU students. These include socio-economic hardships, cultural stigma surrounding mental health, and limited availability of professional support services (Othieno et al., 2014).

This chapter's key sections include the study's background, statement of the problem, purpose, objectives, research questions, significance, scope, delimitations, limitations, assumptions, and theoretical frameworks. Theoretical foundations are drawn from Cognitive-Behavioural Theory (CBT) and the Technology Acceptance Model (TAM), which provide insights into therapeutic principles and factors influencing technology adoption.

1.2 Background of the study

The World Health Organization (2020) highlights that depression is one of the leading causes of disability worldwide. Considered a highly prevalent mental health concern globally, depression is affecting over 300 million people, with university students being especially vulnerable due to academic, social, and financial pressures they naturally experience. Depression significantly affects university students worldwide (World Health Organization, 2020). Socially, untreated depression can lead to isolation, strained relationships, and diminished participation in social activities. These social consequences, combined with academic challenges, intensify mental health issues, thereby negatively affecting the individual's quality of life.

Key global challenges in mental health include limited access to professional care, pervasive stigma associated with seeking treatment, and an uneven distribution of resources that boost access to mental health care. These challenges often prevent timely intervention, particularly in low-resource settings, underscoring the importance of digital mental health tools to help alleviate such barriers (Marsch et al., 2015).

Internationally, there has been a shift towards digital mental health solutions, including CBT-based mobile applications designed to increase access and affordability for individuals in need of mental health support. In the early 2000s, when the World Health Organization (WHO) identified depression as a leading cause of disability worldwide, it brought significant attention to its persistent impact on individuals and health systems alike (Firth et al., 2017). This marked a shift in mental health priorities globally, encouraging the development of interventions aimed at addressing the increasing burden of depression and related disorders. Initially, research on depression focused on general populations and symptom management, mainly relying on traditional face-to-face therapy. By the 1990s, however, researchers

began targeting specific groups, such as university students, who face unique pressures that increase their vulnerability to depression. The early 2000s marked a pivotal shift towards digital interventions, with those utilising Cognitive Behavioural Theory (CBT) emerging as a promising technology-based solution for accessible mental health care (Marsch et al., 2015).

In sub-Saharan Africa, digital health initiatives are progressively gaining support, with mobile health (mHealth) interventions showing promise in addressing various health issues, including mental health. The increasing adoption of smartphones and internet access across the region provides a platform for mental health interventions, like CBT-based self-management mobile applications, to reach a broad audience (Hamilton et al., 2022). As the awareness of mental health needs has grown, so has the drive to make mental health support more accessible, especially for high-risk groups such as students. The evolution of mental health interventions from in-person therapy to digital platforms indicates a readiness to embrace technology-based tools, which are relevant to today's university environments.

Several influential studies have highlighted the impact of depression on university students and the potential of digital interventions to provide support. For example, Lattie et al. (2019) found that a lack of mental health awareness among students often hinders their willingness to seek help, suggesting that digital tools could bridge this accessibility gap. Recent research has demonstrated that CBT-based self-management mobile applications can effectively reduce depression symptoms by providing tools for individuals to track and manage their mental health independently (Hamilton et al., 2022). This aligns with a growing interest in accessible, adaptable mental health interventions, which are particularly beneficial for university students facing barriers to traditional, in-person support.

Mental health resources continue to be scarce in many African countries, with a shortage of mental health professionals and persistent stigma discouraging university students from seeking trained face-to-face counselling. In sub-Saharan Africa, mental health challenges are further exacerbated by the cultural stigma surrounding mental health, scope, acuity, lack of awareness and inadequate resources (Ndeti et al., 2022). For many university students, depression fosters a sense of helplessness and negatively impacts their ability to form supportive networks (Richards & Richardson, 2012).

In Kenya, depression among university students is a growing concern. A study by Othieno et al. (2014) indicates that 35.7% of Kenyan university students experience moderate depressive symptoms, while 5.6% experience severe symptoms. The consequences of untreated depression among university students in Kenya are far-reaching, affecting individuals, institutions, and the nation at large. From an institutional perspective, depression among students increases dropout rates and impacts the overall academic environment. Universities such as South-Eastern Kenya University (SEKU) face challenges in achieving retention and graduation targets due to untreated depression-associated elements.

Students with depression-associated symptoms often experience poor academic performance, absenteeism, and a heightened risk of dropout (Andrews et al., 2021). These challenges can perpetuate a cycle of underachievement and reduced opportunities, limiting their future career prospects and overall quality of life. Over and above the negative effect on the quality of life, untreated depression has been linked to the increasing loss of life associated with young people in institutions of higher learning in Kenya through suicide and homicide, as evidenced by cases continually reported in the local dailies (Standard Media, 2018.)

In Kenya, universities face unique challenges due to overcrowded counselling facilities and limited access to professional mental health services. These issues underscore the urgent need for enhancing accessible and culturally sensitive youth-oriented interventions (Harith et al., 2022). They highlight the need for innovative, stigma-free options, such as CBT-based self-management mobile apps, that offer self-guided mental health support (Adu et al., 2021). Digital CBT-based interventions have the potential to address these issues by offering accessible, adaptable mental health solutions. However, without targeted research, these tools remain underutilised in the Kenyan context (Ndetei et al., 2022).

Despite the promising outcomes of depression intervention observed in other regions, research on the effectiveness of CBT-based apps among university students in low-resource settings, such as Kenya, remains limited. Much of the existing literature focuses on Western populations, leaving a gap in understanding how these tools perform in diverse cultural contexts. Addressing this gap is crucial to broadening the applicability of digital mental health interventions. Current debates in the field include differing opinions on whether digital mental health tools should supplement or replace traditional face-to-face counselling. While some researchers advocate for digital-only approaches, others argue that these apps should complement in-person support, particularly for severe cases, reflecting a lack of consensus on optimal usage (Adu et al., 2021).

Kenya's Ministry of Health emphasises the need for directed mental health interventions to heighten the solutions as part of achieving the sustainability goal for universal healthcare (Ministry of Health, 2020). Digital mental health interventions, particularly those based on Cognitive-Behavioural Therapy (CBT), have demonstrated success in high-resource settings but remain underexplored in low-

resource contexts such as Kenyan universities. The absence of empirical research examining the usability, acceptance, and effectiveness of digital CBT applications in Kenya represents a critical knowledge gap. Moreover, there is a limited understanding of the factors that influence the adoption of digital mental health tools in Kenyan universities.

Historical advancements have led to the current research problem: understanding how accessible digital solutions can effectively address university students' mental health needs. By examining CBT-based self-management mobile applications, this study builds on these shifts towards digital mental health interventions, aiming to fill gaps in knowledge about their effectiveness for students in low-resource settings. These past developments provide a foundation for the current study, which is motivated by the demonstrated potential of digital CBT interventions for improving accessibility. This study aimed to investigate how CBT-based mobile applications can be used to intervene in students' mental health. The study is focused on depression, which is a common mental disorder.

Within Kenyan universities, mental health services are limited, creating a pressing need for alternative support systems that can effectively address these issues (Ndeti et al., 2022). Locally, challenges such as stigma associated with mental health and limited counselling resources discourage students from seeking mental health care even when in need. These challenges emphasise the importance of exploring CBT-based mobile applications, which offer private, accessible support that may encourage more students to engage in mental health care.

The limited research on the effectiveness of CBT-based self-management mobile applications in low-resource settings, particularly among Kenyan university

students, reveals a critical gap. By exploring the effectiveness of these digital tools in managing depression within this context, this study aimed to provide insights that could inform mental health strategies and offer accessible alternatives to traditional face-to-face counselling. This study sought to assess the effectiveness of CBT-based mobile applications in supporting mental health with an inclination to reducing depression among SEKU students where in-person professional counselling services are limited, where two counsellors serve a student population of over 5000 students (SEKU, nd). Given the rising prevalence of depression among university students, investigating digital solutions that can alleviate these challenges is both timely and essential.

1.3 Statement of the problem

Global and local data underscore the pressing need for accessible mental health interventions for university students. Nearly 48% of university students worldwide report experiencing clinically relevant symptoms of depression (Harith et al., 2022). University students face unique challenges, such as academic pressure, social transitions, and financial stress, that increase their vulnerability to depression (Firth et al., 2017). Untreated depression can lead to poor academic performance, social isolation, and reduced productivity, which carries implications for public health and workforce readiness (Richards & Richardson, 2012).

In Kenya, approximately 35.7% of students experience moderate depressive symptoms, while 5.6% experience severe symptoms (Othieno et al., 2014). These statistics illustrate the widespread and severe impact of depression on university populations, with untreated cases leading to critical consequences. The Standard Media (2018) reported that 421 individuals died by suicide in Kenya in the year 2018,

citing mental health challenges as the significant contributing factor. In the same year, a report from Kenyatta National Hospital highlighted that over 100 attempted suicide cases were among the youth, primarily university students who had initially exhibited symptoms of depression, emphasising the urgent need for accessible mental health interventions (Standard Media, 2018).

A study conducted by Wijekoon et al. (2024) highlights how digital tools can provide students with accessible mental health support while bypassing the barriers associated with traditional face-to-face counselling, such as stigma and resource constraints. However, despite the potential of CBT-based mobile applications, limited research exists on their effectiveness in low-resource environments like Kenya, where cultural, economic, and logistical barriers hinder access to mental health services. Much of the study scope centred on Western contexts, leaving a gap in understanding how these digital tools perform in diverse cultural settings. Filling this gap is significant, as it could inform enhanced mental health strategies tailored to the specific needs of university students in Kenya and similar environments.

By exploring the role of CBT-based mobile applications, this study aimed to provide evidence on scalable mental health solutions, offering an accessible alternative to traditional, in-person counselling for depression management (Adu et al., 2021). There seems to be inadequate mental health support for university students in Kenya, where depression is prevalent, but access to in-person professional counselling services remains limited. This research investigates explicitly the potential of Cognitive Behavioural Therapy (CBT)-based self-management mobile applications as enhancement tools to help manage depressive symptoms among university students. By focusing on these digital interventions, the study aim was to determine whether

mobile applications can effectively bridge the gap for students who lack access to traditional counselling services.

This study sought to fill the gap of lack of enough and accessible mental health intervention by assessing the effectiveness of CBT-based self-management mobile applications in managing depression among students at South-Eastern Kenya University (SEKU). By evaluating the feasibility and impact of mobile Apps, the study aims to explore whether such digital interventions can provide viable, accessible support for students facing mental health challenges. This research contributes to the field by offering insights into applying digital mental health tools within a low-resource, culturally diverse setting.

1.4 Purpose of the study

This study aimed to evaluate the effectiveness of CBT-based mobile applications as digital interventions in addressing depression among university students at South-Eastern Kenya University (SEKU). Specifically, the study sought to assess how these applications can serve as practical tools for managing and reducing depression symptoms within the socio-cultural context of South-Eastern Kenya University (SEKU). By examining the usability, user experience, and impact of CBT-based mobile apps, the research sought to provide evidence-based insights into their potential as prompt, real-time and accessible mental health solutions for university students.

1.5 Objectives of the study

The study researched the following listed objectives: -

- i. To determine the prevalence of depression among students at South-Eastern Kenya University.

- ii. To evaluate the feasibility of selected CBT-based self-management mobile applications in managing depression among students at South-Eastern Kenya University.
- iii. To identify barriers affecting CBT-based self-management mobile applications among students at South-Eastern Kenya University.
- iv. To explore the user experience of CBT-based mobile applications among students at South-Eastern Kenya University.
- v. To assess the effectiveness of CBT-based self-management mobile applications in reducing depressive symptoms among students at South-Eastern Kenya University.

1.6 Research Questions

- i. What is the prevalence of depression among students at South-Eastern Kenya University?
- ii. How feasible are CBT-based self-management mobile applications for managing depression among SEKU students?
- iii. What barriers affect the use of CBT-based self-management mobile applications among SEKU students?
- iv. How do SEKU students evaluate their experience in their use of CBT-based mobile applications in reducing depressive symptoms?
- v. To what extent are CBT-based self-management mobile applications effective in reducing depressive symptoms among SEKU students?

1.7 Significance of The Study

This study holds potential significance to the theoretical advancements and enhancing practical applications in digital mental health interventions in a low-

resource and culturally diverse setting. By exploring the application of CBT-based self-management tools, this study broadens the understanding of digital mental health strategies and their applications beyond Western contexts. Findings from this study provide critical insights for other educational institutions like South-Eastern Kenya University, where access to traditional counselling resources is limited. The results offer an additional viable solution for improving mental health strategies within universities in low-resource environments, contributing to the well-being of students who lack immediate access to face-to-face conventional mental health support.

In addition, this study serves as a foundation for future research by highlighting the effectiveness and limitations of digital CBT tools for managing depression among university students. It encourages further exploration of similar interventions across other low-resource settings and could lead to adaptations of CBT-based tools that account for diverse cultural contexts. Moreover, the study's outcomes inform policymakers as well as practitioners in the education and mental health sectors about the benefits of integrating digital mental health solutions in academic institutions.

The study provides actionable insights for improving mental health care in Kenyan universities. By evaluating the usability and adoption of Cognitive-Behavioural Therapy (CBT)-based digital tools, the research identifies practical solutions to address the gaps in existing mental health services in public universities in Kenya. These interventions have the potential to alleviate the strain on overburdened counselling centres and offer accessible alternatives for students who may face stigma when seeking traditional face-to-face mental health support, including professional counselling (Ndeti et al., 2022).

Without this research, essential insights into the feasibility of digital CBT-based tools for students in low-resource settings may remain unexplored. This gap could hinder the development of accessible digital mental health solutions for diverse, under-resourced populations, limiting their access to effective support. Additionally, expanding research focus on Western-centric studies towards diverse localised contexts and customised African-oriented settings in digital CBT-based interventions promotes the field's growth, particularly in its efforts to develop inclusive, culturally relevant and accessible mental health support solutions.

By investigating digital solutions like CBT-based mobile applications, this study could contribute to more accessible mental health support strategies, potentially reducing the academic, social, and economic impacts of student depression. Effective digital interventions may influence mental health practices and policies within educational institutions and beyond. Ultimately, this may enhance and significantly broaden mental health support options for university students, thereby alleviating depression and related effects consequently improving the quality of life.

1.8 Scope of the Study

This study focused on university students enrolled at South-Eastern Kenya University (SEKU) located in Kitui County, Kenya, specifically targeting those who may experience depression. The inclusion of this population was justified by the significant mental health challenges faced by students in Kenyan universities, including limited access to mental health resources and the stigma associated with seeking help (Ndeti et al., 2022). SEKU serves a diverse student population drawn from various regions across the country, making it a representative institution for

examining mental health challenges faced by Kenyan university students. The university is situated in a semi-arid region with limited access to specialised mental health services, which exacerbates the challenges of addressing conditions such as depression (Ndeti et al., 2022).

SEKU's counselling facilities are constrained by inadequate resources and high demand owing to an incredibly low number of service providers vis-a-vis a rapidly growing number of students. This ratio imbalance has birthed a bottleneck, leaving many students without the necessary support to address their mental health needs. The university has employed two professional counsellors to provide counselling support and services to an expansive student body exceeding 5000 individuals (South Eastern Kenya University, n.d.). This significant imbalance highlights a critical need for additional counselling resources to ensure adequate and timely mental health support for the entire student population.

About seventy-five per cent of the student population is accommodated off-campus in small rural and semi-urban settlements neighbouring the institution (Ngila, 2020). Consequently, the costs associated with transport to and out of the university pose a significant barrier, hindering ability to access the counselling services provided exclusively within the university premises during work hours when they most require counselling support. Additionally, cultural stigma surrounding mental health issues discourages students from seeking traditional face-to-face counselling services. These challenges made SEKU an ideal case study for exploring the feasibility and effectiveness of CBT-based digital interventions. Insights from this research can inform similar efforts in other Kenyan universities facing comparable constraints.

1.9 Delimitations of the Study

The study evaluated CBT-based digital interventions and analysed their usability and effectiveness in addressing depression. These interventions were selected because they offer prompt, cost-effective solutions for low-resource settings like SEKU. The study also incorporated the Technology Acceptance Model (TAM) to understand the factors influencing the adoption of these tools, focusing on perceived usefulness and ease of use (Venkatesh & Davis, 2000).

Additionally, the study examined socio-cultural factors affecting mental health care, providing a comprehensive analysis to inform practical solutions for SEKU and similar institutions.

1.10 Limitations of the Study

This study faced several methodological constraints that influenced data collection and analysis. One of the primary challenges was the reliance on self-reported data from students at South-Eastern Kenya University (SEKU). Self-reported measures, while useful, can introduce biases such as social desirability bias, where participants may under-report or exaggerate their experiences with depression due to stigma (Ndeti et al., 2022). Another challenge lay in sampling. Given the nature of experimental studies, the study adopted a purposive sampling method, which may limit the generalizability of findings to other universities or populations.

Furthermore, the complexity of analysing cultural and contextual influences on mental health adoption presented difficulties, requiring nuanced interpretation of qualitative data to ensure accuracy and relevance. Also, the study faced several practical constraints that limited its scope and implementation. These limitations

restricted the scale of the study and the diversity of methods that were employed for data collection (Ndeti et al., 2022).

Moreover, the timeline for conducting the research was constrained by academic schedules and student availability. University breaks and examination periods significantly impacted participant engagement, potentially reducing response rates. The reliance on digital interventions also assumed consistent access to reliable internet and devices, which was not the case for some students, particularly those from lower socio-economic backgrounds (Venkatesh & Davis, 2000) and those who lacked smartphones or money to purchase data bundles. Finally, logistical challenges such as gaining approval from institutional review boards and coordinating with university administrators caused delays, further complicating the research process.

1.11 Assumptions of the study

This study assumed that the data collection tools, such as questionnaires and usability assessments, were effective in capturing valid and reliable information about depression and experiences related to the adoption of digital interventions. Participants were expected to respond honestly, ensuring accurate reflections of their experiences with mental health challenges and digital tools (Ndeti et al., 2022).

It was also assumed that the sample size would adequately represent the student population at South-Eastern Kenya University (SEKU). Furthermore, the study presumed that participants possessed sufficient digital literacy to effectively engage with CBT-based interventions and complete related assessments (Richards & Richardson, 2012).

This study also assumed that South-Eastern Kenya University's cultural and social context (SEKU) would support the feasibility of implementing CBT-based

digital interventions. Participants were presumed to be open to discussing mental health challenges and engaging with digital solutions despite the existing cultural stigma surrounding mental health in Kenya (Ndeti et al., 2022).

It also assumed that institutional support from SEKU administration would facilitate the smooth execution of the study, including approval for data collection and collaboration in reaching participants. Additionally, the study presumed that access to smart mobile devices was sufficient to engage participants in digital interventions.

1.12 Theoretical Framework

The theoretical framework of this study was shaped by the integration of Aaron Beck's Cognitive-Behavioural Theory (CBT) and the Technology Acceptance Model (TAM) developed by Fred D. Davis in 1989. These two frameworks complemented each other, with CBT providing the psychological foundation for addressing depression and TAM offering insights into the technological adoption of the intervention. Together, they created a holistic approach that addressed the study's therapeutic and practical dimensions.

1.12.1 Cognitive-Behavioural Theory

Cognitive-behavioural therapy (CBT), developed by Aaron T. Beck in 1976, is a psychological approach that focuses on the interplay between thoughts, emotions, and behaviours. The theory operates on the premise that dysfunctional thought patterns lead to maladaptive behaviours and emotional distress. By identifying and restructuring these thoughts, CBT aims to foster healthier emotional responses and behaviours (Beck, 1976). Key concepts in CBT include cognitive distortions, such as overgeneralisation and catastrophising, which negatively influence an individual's perception of their experiences.

Cognitive-Behavioural Therapy employs techniques such as cognitive restructuring, where individuals challenge and replace irrational beliefs with constructive alternatives. Another essential component is behavioural activation, which encourages individuals to engage in meaningful activities to counteract withdrawal and inactivity associated with depression (Richards & Richardson, 2012). CBT is highly structured, goal-oriented, and typically short-term, making it accessible and adaptable across diverse settings.

Over time, CBT has gained widespread recognition due to its evidence-based effectiveness in treating depression, anxiety, and other mental health disorders. Its adaptability to various delivery methods, including face-to-face therapy, self-help books, and digital platforms, underscores its versatility (Andrews et al., 2021). While originally developed for individual therapy, CBT has evolved to suit broader applications, such as group therapy and digital interventions, making it a robust framework for addressing mental health challenges in both high- and low-resource environments.

In this study, CBT provided the foundational principles for designing the therapeutic content of the digital intervention, emphasising the modification of negative thought patterns and behaviours. This framework was essential for ensuring that the intervention addressed the core psychological challenges faced by participants. CBT served as the foundational theory for developing and assessing digital interventions aimed at managing depression among university students at SEKU. Depression in this context often stems from academic pressures, financial difficulties, socio-cultural dynamics, and limited access to mental health services. Cognitive Behavioural Theory's structured and goal-oriented approach makes it particularly

suitable for addressing these challenges, as it provides practical strategies to manage negative thought patterns and behaviours (Beck, 1976).

The study leveraged CBT principles in a digital format, incorporating interactive modules, quizzes, and exercises that mirrored traditional face-to-face therapeutic techniques. For example, students engaged in cognitive restructuring activities to challenge irrational beliefs and develop healthier perspectives. Behavioural activation exercises encouraged participation in meaningful activities, which had the potential to improve mood and reduce feelings of isolation (Richards & Richardson, 2012). By digitising CBT, the study sought to overcome barriers such as stigma surrounding mental health and the limited availability of professional counsellors, which are prevalent in Kenyan universities (Ndeti et al., 2022).

Additionally, CBT's flexibility allowed it to be culturally adapted to the unique needs of SEKU students. While CBT's core principles are universally applicable, cultural nuances, such as collectivist values and spiritual beliefs, were integrated into the intervention design. This ensured that the digital tools resonated with the socio-cultural realities of the participants, enhancing their usability and acceptance.

Critically, while CBT has demonstrated global efficacy, its success in low-resource contexts like Kenya depended on proper adaptation and accessibility. The study explored whether CBT-based digital tools could maintain their effectiveness in a non-Western setting, contributing valuable insights to the broader application of CBT in diverse cultural and economic environments.

1.12.2 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), developed by Fred D. Davis in 1989, is a theoretical framework designed to explain and predict user acceptance of technology. TAM posits that two primary factors—perceived usefulness and perceived ease of use—determine an individual's intention to adopt and use a technology. Perceived usefulness is defined as the degree to which a person believes that using a technology will enhance their performance, while perceived ease of use refers to the degree to which they perceive the technology as being free of effort (Davis, 1989).

Perceived usefulness is critical in contexts where the adoption of technology directly impacts outcomes, such as health improvements or efficiency gains. For example, students may adopt a CBT-based digital tool if they believe it would effectively alleviate depressive symptoms and improve their mental well-being (Davis, 1989). Perceived ease of use is equally important, as users are more likely to engage with a technology that they find intuitive and accessible. For instance, a user-friendly interface and clear navigation are essential features of digital mental health applications, particularly for users with limited technological experience (Venkatesh & Davis, 2000).

The technology Acceptance Model also incorporates external variables, such as user characteristics, cultural factors, and environmental conditions, which can influence both perceived usefulness and ease of use. In the context of Kenyan universities, these external factors might include technological infrastructure, digital literacy, and cultural attitudes toward mental health. By addressing these variables,

TAM provides a comprehensive framework for understanding the factors that drive or hinder technology adoption in diverse settings (Venkatesh et al., 2003).

In this study, TAM is highly relevant as it provides a structured approach to evaluating the adoption of CBT-based digital interventions among university students at SEKU. Depression remains a significant challenge for these students, yet traditional mental health services are often inadequate or inaccessible due to limited resources and stigma (Ndeti et al., 2022). TAM's constructs helps identify the factors influencing students' acceptance of digital mental health tools.

The Technology Acceptance Model also accounts for external factors that affected adoption, such as the availability of mobile devices and internet connectivity, cultural attitudes toward technology, and stigma surrounding mental health. For instance, while smartphone penetration in Kenya was increasing, disparities in access to technology could impact the adoption of digital mental health solutions (Statista, 2021). By integrating TAM into this research, the study evaluated the effectiveness of CBT-based self-management digital tools and the socio-cultural and technological factors that affected their adoption. This dual focus ensures that the findings are both practical and culturally sensitive, offering insights for scaling digital mental health interventions in similar settings. Integrating these two theories ensures that the intervention is both psychologically effective and technologically feasible. CBT ensures the intervention's alignment with evidence-based therapeutic practices, while TAM ensures its acceptance and usability within South-Eastern Kenya University's socio-cultural and economic context.

1.13 Conceptual Framework



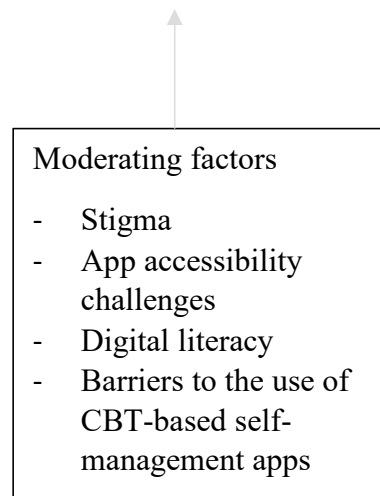


Figure 1.1: Conceptual framework model for Depression management

The conceptual framework diagram visually illustrates the relationships between key variables in this study, highlighting how the independent variables (characteristics of CBT-based self-management mobile applications) are expected to influence the dependent variables (depression symptom reduction and mental well-being among students). Moderating factors, such as stigma and accessibility, are also depicted to add depth to the analysis.

This framework's independent variables include usability, feasibility, and user satisfaction with CBT-based mobile applications. These characteristics are essential for determining whether students perceive the applications as practical and effective for managing depression. The dependent variables are the primary outcomes: reduced depression symptoms and improved overall mental well-being among SEKU students. These outcomes measure the effectiveness of CBT-based mobile applications in supporting students' mental health by helping them manage symptoms and enhance emotional resilience through accessible, self-guided tools.

Moderating variables in this framework include factors such as mental health stigma, barriers to the use of the CBT-based mobile apps, accessibility challenges such as internet availability, and digital literacy. These moderating factors may have impacted the degree of engagement students had with the applications, thereby influencing the strength of the relationship between the independent and dependent variables. For instance, high levels of stigma could have deterred some students from using the app consistently, weakening the overall effect on mental health outcomes.

The conceptual framework guided data analysis by structuring the evaluation of each variable's influence on the outcomes. By clearly outlining expected relationships, the framework ensured that the study systematically examined how usability, feasibility, and user satisfaction affect depression symptom reduction and student well-being. This framework complemented the theoretical foundation by operationalising key CBT concepts, such as behavioural activation and cognitive restructuring, in the context of digital applications. Aligning the conceptual framework with the theoretical foundation provided a cohesive approach that bridged theory and practice, reinforcing the study's focus on application effectiveness.

Additionally, the framework shaped findings by providing insights into how different application characteristics impact mental health outcomes. For instance, since it was realised that usability strongly correlated with depression symptom reduction, these findings could inform future self-management mobile app development, emphasising additional pathways through which digital mental health applications may significantly benefit university students in low-resource settings.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter is structured into four main sections. It explores the theoretical foundations while examining empirical findings on the effectiveness of CBT-based mobile applications. It reviews barriers to adopting these interventions, such as user acceptance, cultural influences, and technological constraints. Lastly, it assesses user experience factors, focusing on design elements that affect engagement and effectiveness.

Building upon the foundational concepts already introduced, this literature review avoids reiterating general background information, problem statements, or detailed theoretical descriptions already covered. Instead, it provides an in-depth exploration of general and empirical insights, offering a nuanced understanding of the topic. By critically synthesising existing research, this chapter identifies gaps where knowledge remains limited, setting the stage for the current study to contribute new insights into the adoption and effectiveness of digital mental health interventions among university students.

2.2 Review of the Literature

A study by Kanuri et al. (2020) examined the adoption of mental health apps among college students in India, revealing that perceived usefulness strongly influenced engagement. Participants who believed the app would effectively alleviate depressive symptoms were more likely to continue using it regularly. However, the study also noted that ease of use played a pivotal role, particularly for users unfamiliar

with digital tools. Intuitive interfaces and clear navigation structures significantly increased adoption rates, underscoring the importance of user-centred design in digital mental health interventions.

Similarly, research by Wijekoon et al. (2024) explored the adoption of CBT-based apps in sub-Saharan Africa. The findings indicated that while many participants valued the apps' functionality, cultural stigma surrounding mental health and technological barriers hindered sustained use. For instance, off-campus students in rural areas reported difficulty accessing online features due to unreliable internet connectivity. This highlights the need for offline capabilities and culturally adapted content to enhance app appeal and usability in diverse contexts.

In Kenya, a pilot study conducted by Mwavua et al. (2023) tested a web-based mental health platform among adolescents during the COVID-19 pandemic. The study found that participants prioritised apps offering privacy and anonymity, reducing stigma concerns. Furthermore, personalised features such as mood tracking and behavioural training exercises were highly appreciated, demonstrating the importance of tailoring apps to meet specific user needs. However, the study identified challenges related to inconsistent internet access and limited awareness of available apps, suggesting that educational campaigns could improve adoption rates.

Another relevant study by Naslund et al. (2019) investigated the adoption of digital mental health tools in low-resource settings. Their results showed that apps incorporating gamification elements, such as rewards and progress tracking, enhanced user motivation and adherence. Additionally, apps with simplified language and localised examples resonated better with users, highlighting the importance of cultural relevance in app design. Despite these successes, the study acknowledged gaps in

understanding long-term adoption patterns, calling for further research into sustaining user engagement over extended periods.

While existing literature underscores the importance of perceived usefulness and ease of use in driving app adoption, there remains a need for deeper exploration of socio-cultural and contextual factors influencing acceptance in non-Western settings. For example, studies have yet to thoroughly examine how family support, peer influence, or institutional backing impact the adoption of CBT-based apps among Kenyan university students. Addressing these gaps will provide valuable insights into optimising app design and implementation strategies for this demographic.

2.2.1 Prevalence of Depression Among University Students

Depression is one of the most prevalent mental disorders globally, significantly impacting university students due to academic pressures, social transitions, and financial stressors (Ibrahim et al., 2013). The World Health Organization (WHO) identifies depression as a leading cause of disability worldwide, with a substantial proportion of cases emerging during young adulthood (WHO, 2017). These factors underscore the critical need for targeted interventions that are accessible and scalable, such as digital Cognitive-Behavioural Therapy (CBT) applications.

Globally, research highlights alarming rates of depression among university students. A meta-analysis by Rotenstein et al. (2016) found that approximately 27% of university students experience depressive symptoms, with variations across regions. While high-income countries often have adequate access to mental health services, which may reduce the severity of depressive episodes, stigma and underutilisation of available services remain persistent barriers (Eisenberg et al., 2013).

Despite its robust methodology, Rotenstein et al.'s (2016) meta-analysis primarily focused on Western populations, leaving a gap in understanding the prevalence and contributing factors among university students in low-resource settings like Kenya. Additionally, the study did not explore cultural influences on help-seeking behaviour or the effectiveness of digital interventions in diverse contexts.

Digital mental health solutions have shown promise in addressing these challenges by providing low-cost, prompt, real-time interventions that bypass traditional stigma (Bockting et al., 2021). However, the extent to which these tools can address the unique needs of university students in low-resource settings remains underexplored.

In sub-Saharan Africa, the prevalence of depression among university students is exacerbated by socio-economic hardships, limited access to mental health care, and cultural stigma (Mwangi et al., 2022). For instance, a study conducted by Peltzer et al., (2013) in Obafemi Awolowo University in Ile-Ife, Western Nigeria reported that 36.4% of university students exhibited moderate to severe depressive symptoms (Peltzer et al., 2013). This study emphasised the role of financial strain, academic pressure, and lack of institutional support in increasing vulnerability to depression. Peltzer et al.'s (2013) study provided valuable insights into the prevalence of depression among Nigerian university students but relied heavily on self-reported data, which may introduce bias. Furthermore, the researchers called for studies that evaluate the effectiveness of targeted mental health interventions, including counseling services and peer support programs, within university environments which could embrace the use of digital interventions in addressing mental health challenges.

In Kenya, the prevalence of depression among university students mirrors regional trends. Studies suggest that nearly 40% of students in Kenyan universities exhibit depressive symptoms, with a significant proportion failing to seek professional help due to stigma or lack of resources (Gatwiri & Kinyanjui, 2020).

A recent study was conducted by Ndeti et al. (2022) focussing on understanding the prevalence and risk factors of suicidal ideation among Kenyan students. In the study, 9,742 students aged 15 years and above from high school, college, and university levels across Nairobi, Machakos, Kitui, and Makueni counties in Kenya, revealed that 22.6% of participants reported suicidal ideation within the previous two weeks, with 20% meeting criteria for major depression and others experiencing significant levels of stress, affectivity disorders, and psychosis. The researchers identified that mental health challenges, particularly among female students and those in economically disadvantaged households, were significant predictors of suicidal thoughts. The cross-sectional study emphasized the urgency of implementing targeted mental health interventions, particularly for vulnerable youth populations, and underscored the broader implications for public health strategies in low-resource settings. Ndeti et al.'s (2022) study identified risk factors for suicidal ideation but did not evaluate the effectiveness of specific interventions, including digital CBT-based tools. This gap limits understanding of how these tools could address the root causes of depression and improve outcomes among Kenyan university students.

Similarly, Gatwiri and Kinyanjui (2020) explored the mental health challenges faced by university students in Kenya, reporting that 35.7% experienced moderate depressive symptoms, while 5.6% experienced severe symptoms. The study

emphasised the importance of culturally relevant and accessible interventions, particularly for off-campus students who face additional barriers such as isolation and limited access to mental health services. While Gatwiri and Kinyanjui (2020) highlighted the need for innovative interventions, their study did not evaluate digital mental health tools' feasibility and effectiveness in addressing depression. This omission leaves a critical gap in understanding whether CBT-based apps can effectively bridge Kenyan universities' mental health care gap.

The reviewed literature demonstrates a high prevalence of depression among university students globally, regionally, and within Kenya. Academic pressure, financial strain, social transitions, and cultural stigma are key drivers. However, existing studies fall short in several areas. Many studies focus on Western populations, leaving gaps in understanding how cultural factors influence depression prevalence and intervention effectiveness in non-Western settings. On the other hand, there are few studies that specifically address the unique challenges faced by off-campus students, who often experience higher levels of depression due to isolation and limited access to support systems.

2.2.2 Feasibility of CBT-based mobile applications in Managing Depression

Feasibility of a CBT-based app refers to how practical and acceptable it is to deliver cognitive behavioral therapy via mobile technology, based on factors like user engagement and adherence (Bisconti et al., 2024). The high prevalence of depression among university students globally, regionally, and in Kenya underscores the urgency of developing innovative mental health solutions. Mobile applications are increasingly being used by university students as useful tools for mental health in Western contexts. Empirical evidence suggests that digital CBT interventions have the potential to fill

critical gaps in mental health care delivery, particularly in low-resource settings. These tools can provide students with accessible mental health support while bypassing the barriers associated with traditional face-to-face counselling, such as stigma and resource constraints (Wijekoon et al., 2024).

However, the success of such interventions depends on their ability to address contextual challenges, including cultural stigma and technological limitations. By addressing cultural and contextual barriers, these tools can play a pivotal role in improving mental health outcomes for university students. A study by Oliveira et al. (2021) provides basic evidence of the digital intervention's efficacy in reducing anxiety, stress, and depression among students during increased demand season such as the COVID-19 pandemic. The study highlighted that digital interventions, particularly those aligned with psychological theories of treating depression, are generally well-accepted by students and can help relieve the burden on university counselling services. The study found that 68% of students who used mobile apps for mental health reported a significant reduction in depression and anxiety symptoms. The average reduction in depression and anxiety scores was 20% for 8 weeks.

Another study by Almuqrin et al. (2024) underlined the irrefutable effectiveness, feasibility, and acceptability of smartphone apps for various mental health illnesses, including depression. The study reported a 25% improvement in overall mental health and a 30% reduction in depression symptoms amongst students expending selected mental health mobile apps. 80% of the participants persistently used the app for the entire study period, signifying high suitability and feasibility.

Nonetheless, the study noted challenges, including reduced feasibility over time owing to user engagement, technical issues, and sustainability. The study

established that participants' engagement with the mobile apps tended to decline over time, leading to decreased feasibility and, in consequence, reduced effectiveness of the apps in reducing depression symptoms. This decline in engagement was attributed to factors such as lack of motivation, loss of interest, and the newness of the mobile app starting to wear off. The study recommended solutions including gamification incorporating game-like elements such as rewards, challenges, and progress tracking, as well as personalisation to customise the app experience based on individual user preferences and needs to make it more relevant and engaging, and continuously updating the app with new content, features, and improvements to maintain user interest.

In Kenya, a study conducted by Mwavua S. et. al. (2023) aimed at developing a digital web-based platform to support adolescent's mental health and psychosocial needs during the COVID-19 pandemic. The platform was found to be feasible and effective in addressing mental health gaps among adolescents and young people in Kenya, highlighting that 70% of the participants reported a reduction in anxiety symptoms after using the platform for three months.

Another study by Ali, F. H. (2021) focused on designing a mobile-based system for mental health patients in Kenyan universities. The mobile system facilitated treatment sessions between doctors and patients, provided treatment interactions, and tracked patient progress. It was found to be feasible and effective in managing anxiety symptoms among university students. The study recounted that 65% of the participants experienced a noteworthy reduction in anxiety symptoms after using the mobile-based system for six months.

2.2.3 Barriers to Using CBT-Based Mobile Applications in managing depression symptoms

The adoption of digital mental health interventions, particularly Cognitive-Behavioural Therapy (CBT)-based applications, is influenced by numerous barriers and facilitators. These factors vary significantly across different socio-economic and cultural contexts. Understanding these dynamics is critical for developing effective strategies to promote using CBT apps, especially in resource-constrained environments like Kenya.

Several barriers hinder the adoption of CBT-based mobile applications globally, with unique challenges emerging in low-resource settings. One of the primary obstacles is the stigma associated with mental health. In Kenya, cultural perceptions often frame mental health issues as personal weaknesses, deterring individuals from seeking help (Ndeti et al., 2010). This stigma extends to the use of digital mental health tools, as users fear being judged for engaging with such interventions.

Technological limitations also play a significant role. Limited access to smartphones, unstable internet connections, and low levels of digital literacy are significant barriers in sub-Saharan Africa. A study by Gatwiri and Kinyanjui (2020) found that 38% of Kenyan university students cited unreliable internet access as a reason for discontinuing their CBT-based app. Moreover, the high cost of internet data further restricts access, particularly among economically disadvantaged populations.

Another critical barrier is the lack of culturally relevant content. Many CBT apps are designed in high-income countries, with little consideration for users' cultural

and linguistic needs in low-resource settings. This disconnect often leads to reduced engagement and perceived usefulness of the tools (Wijekoon et al., 2024).

Despite these challenges, several facilitators can enhance the adoption of CBT-based mobile applications. Privacy and anonymity are among the most significant enablers. Digital tools allow users to seek mental health support discreetly, bypassing the stigma associated with face-to-face therapy (Naslund et al., 2019). This is particularly relevant in Kenyan contexts, where cultural stigmas around mental health are pervasive.

Institutional support is another crucial facilitator. Universities that integrate CBT-based apps into their mental health services provide a supportive environment encouraging student adoption. For example, pilot programs in South African universities have shown that providing free access to CBT apps significantly increases usage rates (Peltzer & Pengpid, 2013). This finding suggests that similar initiatives could be effective in Kenyan universities.

The perceived usefulness and ease of use of CBT apps also drive adoption. When users find these tools intuitive and beneficial in addressing their mental health needs, they are more likely to engage with them. Incorporating culturally relevant content and user-friendly interfaces can enhance these perceptions (Denecke et al., 2022).

While barriers such as stigma, technological limitations, and lack of cultural relevance hinder the adoption of CBT-based apps, facilitators like privacy, institutional support, and user-friendly designs present opportunities for increasing usage, however, the interplay between these factors is complex. For instance, while

privacy can encourage adoption, it may also limit opportunities for peer or professional support, which are critical for sustained engagement. Additionally, addressing technological and cultural barriers requires significant investment in infrastructure and localised content development.

Understanding barriers and facilitators is essential for tailoring CBT-based interventions to the Kenyan context. Future research should explore innovative strategies to reduce stigma, such as community-based awareness campaigns. Collaborating with local developers can also ensure that CBT apps are culturally adapted and accessible. From a practical perspective, universities should consider internet costs and integrating these tools into their mental health programs to maximise impact.

A complex interplay of barriers and facilitators shapes the adoption of CBT-based mobile applications. While challenges like stigma and technological limitations persist, opportunities exist to enhance adoption through privacy, institutional support, and culturally relevant designs. Addressing these factors is crucial for realising the potential of CBT apps in improving mental health outcomes for Kenyan university students.

2.2.4 User Experience of CBT-Based Mobile Applications in managing depression symptoms

Usability and user experience are critical factors influencing the success of digital mental health interventions, particularly Cognitive-Behavioural Therapy (CBT)-based mobile applications. These features determine how effectively users engage with the app and whether they perceive it as a valuable tool for managing depressive symptoms. Studies have consistently demonstrated that intuitive interface design, personalization, and accessibility are pivotal in enhancing user engagement

and adherence (Naslund et al., 2019). In culturally diverse settings like Kenya, usability is further influenced by the app's ability to meet its target population's specific needs and preferences.

A review by Torous et al. (2018) emphasised the importance of minimalistic, easy-to-navigate interfaces in reducing user cognitive load. The study found that apps with cluttered designs or overly complex navigation structures often deterred users from sustained engagement. While this review provided valuable insights into interface design, it primarily focused on high-income countries, leaving a gap in understanding how these principles apply to low-resource settings where digital literacy may vary. Additionally, the study did not explore cultural adaptations necessary for non-Western contexts, which could limit the generalizability of its findings.

Similarly, Naslund et al. (2019) highlighted the role of interactive features, such as progress tracking and real-time feedback, in enhancing user satisfaction and adherence. However, the study lacked depth in addressing challenges related to intermittent internet access, a significant issue in low-resource environments like Kenya. This limitation suggests a need for future research to investigate offline capabilities and their impact on usability.

Personalization features, such as tailored content based on user preferences or symptom severity, have increased the perceived relevance and effectiveness of CBT-based apps (Denecke et al., 2022). For example, Firth et al. (2017) noted that apps offering a blend of educational content and actionable exercises maintained higher levels of user engagement. Despite these positive outcomes, the study failed to adequately address the potential barriers posed by limited digital literacy, particularly

among populations unfamiliar with self-management tools. This gap highlights the need for simplified interfaces and additional support mechanisms during initial use.

Cultural relevance is another critical factor in improving usability. Research by Naslund et al. (2019) underscored the importance of integrating local languages and culturally appropriate examples into app content. A study conducted in South Africa incorporated culturally familiar metaphors and idioms, significantly enhancing user engagement (Peltzer & Pengpid, 2013). However, the study did not delve deeply into the long-term effects of cultural adaptation, leaving unanswered questions about sustained engagement over time.

In Kenya, Gatwiri and Kinyanjui (2020) tested a culturally tailored CBT-based app designed for university students. The app included content in both English and Swahili and addressed local stressors such as academic pressure and financial challenges. Participants reported high levels of satisfaction with the app's content but noted that its interface design could be further simplified to accommodate varying levels of digital literacy. While this study made strides in cultural adaptation, it overlooked the importance of offline functionality, which could improve accessibility for users with unreliable internet connections.

Studies examining usability in low-resource settings reveal several unique challenges. For instance, Kanuri et al. (2020) explored the feasibility of digital mental health interventions among college students in India. Their findings indicated that while participants appreciated the flexibility of self-guided apps, many encountered difficulties due to limited internet access and unfamiliarity with app navigation. However, the study did not propose specific solutions to overcome these barriers, leaving a gap in practical recommendations for developers targeting similar contexts.

Another study by Wijekoon et al. (2024) investigated the usability of CBT-based apps among young adults. While the authors identified key features such as mood tracking and guided journaling as highly valued by users, they neglected to examine the impact of socioeconomic disparities on app adoption. This oversight limits the applicability of their findings to resource-constrained environments where affordability and accessibility remain critical concerns.

Despite advancements in understanding usability and user experience, several gaps persist. Most studies focus on short-term usability, failing to assess how user experiences evolve over extended periods. Longitudinal research is essential to evaluate sustained engagement and identify potential drop-off points. Additionally, limited attention has been given to designing apps with robust offline capabilities, which are crucial for users in areas with poor internet connectivity.

Addressing these gaps requires targeted research focusing on low-resource settings. Studies that can investigate the long-term usability of CBT-based apps among university students in Kenya or develop and test apps with enhanced offline functionality to overcome internet access barriers.

From a practical perspective, partnerships between universities, mental health professionals, and local developers can ensure that CBT apps are accessible and meaningful to their intended audience. By prioritizing user-centred design and involving end-users throughout the development process, developers can create tools that effectively address the mental health needs of university students in diverse, low-resource settings.

2.2.5 Effectiveness of CBT-based mobile applications in reducing depression symptoms

Cognitive-Behavioural Therapy (CBT)-based mobile applications have emerged as effective tools for managing depression, particularly in addressing barriers to access and scalability. These digital interventions incorporate CBT principles into self-guided programs, offering users structured exercises such as mood tracking, cognitive reframing, and behavioural activation (Denecke et al., 2022). Empirical evidence suggests that these applications can significantly reduce depressive symptoms, making them a promising alternative to traditional face-to-face counselling.

Studies conducted in high-income countries provide robust evidence for the efficacy of CBT-based apps in reducing depressive symptoms. For instance, Firth et al. (2017) conducted a meta-analysis of randomized controlled trials (RCTs) and found that users of CBT-based apps reported a 43% reduction in depression scores compared to control groups. Similarly, Wright et al. (2020) noted that these apps were particularly effective in mild-to-moderate cases, providing immediate relief and preventing symptom escalation.

The effectiveness of CBT-based apps in low-resource settings, including sub-Saharan Africa, is gaining attention. Naslund et al. (2019) highlighted that CBT apps could be adapted to resource-constrained environments by simplifying content and incorporating local languages. Their study demonstrated significant promise in addressing stigma by allowing users to access mental health support privately. Participants reported a notable reduction in depressive symptoms, with improvements attributed to features such as mood tracking and guided journaling. Despite its strengths, Naslund et al.'s (2019) study primarily focused on short-term outcomes and did not explore the long-term sustainability of app usage. Additionally, the study

relied heavily on self-reported data, which may introduce bias and limit the reliability of findings. Future research should incorporate objective measures and longitudinal designs to address these limitations.

In Kenya, few studies have rigorously evaluated the effectiveness of CBT-based apps among university students. A pilot study by Gatwiri and Kinyanjui (2020) tested a culturally adapted CBT app, reporting a 32% reduction in depressive symptoms over eight weeks. The study emphasised the importance of cultural relevance, user-friendly design, and offline capabilities in enhancing engagement and adherence.

Gatwiri and Kinyanjui's (2020) study was limited by its small sample size and reliance on convenience sampling, which may affect the generalizability of findings. Furthermore, while the study identified key challenges such as inconsistent internet access and low digital literacy, it did not propose comprehensive strategies to address these barriers. Future research should involve larger, more representative samples and explore innovative solutions to overcome technological and cultural obstacles.

Despite their potential, CBT-based apps face significant user engagement and adherence challenges. Globally, drop-off rates remain high, with many users abandoning the apps after initial use (Firth et al., 2017). This challenge is exacerbated in low-resource settings, where factors such as limited internet access, stigma, and cultural differences further complicate adoption. Firth et al. (2017) highlighted the issue of drop-off rates but did not delve deeply into strategies to enhance user engagement or sustain interest over time. Future research should investigate gamification, personalized feedback, and community-based support systems to improve adherence, particularly in resource-constrained contexts.

Some researchers advocate for blended models that combine digital CBT apps with occasional in-person counselling sessions. The study by Rathbone and Prescott (2017), conducted in the United Kingdom, systematically reviewed eight randomized controlled trials to assess the efficacy of mobile health (mHealth) apps that incorporate cognitive behavioral therapy (CBT) principles for treating various mental health conditions. The review included studies with diverse participant groups experiencing issues such as depression, anxiety, and stress, and examined both standalone app interventions and those used alongside other treatments. Findings revealed moderate to large effect sizes in symptom reduction, particularly when apps were used in blended models that combined digital CBT with minimal therapist support, such as brief weekly check-ins. The authors concluded that while CBT-based apps show promise, their long-term effectiveness and engagement rates require further investigation, and they recommended future research focus on improving app design, enhancing user adherence, and evaluating blended care models to optimize mental health outcomes.

While existing literature demonstrates the potential of CBT-based apps in managing depression, several critical gaps remain. Most studies focus on short-term outcomes, leaving questions about sustained impact unanswered. Many apps lack culturally relevant content, which limits their appeal and usability in non-Western contexts. Additionally, limited internet access and low digital literacy hinder adoption, particularly in low-resource settings like Kenya. Moreover, few studies that specifically target university students, especially in African contexts, limiting the applicability of findings to this demographic.

Addressing these gaps is essential for optimizing the design, implementation, and effectiveness of CBT-based apps in managing depression among university students in Kenya and similar settings. By incorporating culturally relevant content, addressing technological barriers, and enhancing user engagement, developers and researchers can create more impactful interventions that meet the unique needs of this population.

2.4 Summary of Review of Literature and Research Gaps

The literature review provided an in-depth exploration of the theoretical and empirical contexts surrounding digital mental health interventions, particularly Cognitive-Behavioural Therapy (CBT)-based applications. By examining global, regional, and Kenyan-specific trends, this review highlighted key insights into the prevalence of depression among university students, the effectiveness of CBT-based apps, barriers and facilitators to adoption, and usability considerations.

Globally, empirical evidence supports the efficacy of CBT-based apps in reducing depressive symptoms, particularly in high-income countries where technological infrastructure and digital literacy are advanced (Firth et al., 2017). In sub-Saharan Africa, including Kenya, these tools have shown promise in overcoming barriers such as stigma and lack of mental health resources (Gatwiri & Kinyanjui, 2020). However, the success of these interventions depends heavily on usability features, cultural relevance, and sustained user engagement.

Barriers to adoption, such as stigma, technological limitations, and lack of culturally tailored content, were identified as significant challenges. Facilitators, including privacy, institutional support, and user-friendly designs, emerged as critical

enablers. Usability features like intuitive interfaces, localized content, and personalized feedback enhance engagement and adherence in culturally diverse settings (Naslund et al., 2019).

The synthesis of findings demonstrates the potential of CBT-based apps to address the mental health needs of Kenyan university students. However, achieving this potential requires addressing significant barriers and leveraging identified facilitators to ensure these tools are accessible, culturally relevant, and effective in their intended contexts. By exploring long-term outcomes, enhancing cultural adaptations, improving usability, and fostering local collaboration, this study aimed to contribute meaningful insights into the adoption and effectiveness of CBT-based self-management mobile apps in reducing depression in Kenya. These efforts will inform the development of more effective interventions and support broader mental health initiatives in similar low-resource settings.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter begins by detailing the research design, which integrates both quantitative and qualitative approaches to capture measurable outcomes and user experiences. The target population is outlined, then the study sample, explanation of how the sample size was determined and the procedures used to recruit participants. This is followed by a detailed account of the data collection process, including the instruments utilized, their pre-intervention testing for reliability and validity, and the steps to ensure accurate data gathering (Bryman, 2012). The data processing and analysis section then elaborates on the methods used to analyse quantitative and qualitative data, providing insights into the statistical and thematic techniques employed.

3.2 Research Design

This study used quasi-experimental designs utilizing the mixed-methods approach to address the research objectives comprehensively. According to Creswell and Plano Clark (2017), mixed methods design integrates quantitative and qualitative methods to provide comprehensive insights to understand a problem, while quasi-experimental designs focus on identifying causal relationships using intervention and comparison groups.

The quantitative component used PHQ-9 scores to measure depression levels before and after the intervention, providing measurable data on the effectiveness of the CBT-based mobile applications. Simultaneously, the qualitative component captured user experiences through structured questionnaires, offering deeper insights

into participants' perceptions, usability concerns, and challenges encountered during the selected app use. This approach ensured a balanced evaluation of the statistical impact and contextual factors influencing the intervention's success.

The quasi-experimental design facilitated comparisons between the experimental and control groups, enabling the establishment of cause-and-effect relationships within the constraints of real-world settings. By integrating numerical data with qualitative insights, the mixed-methods approach enhanced validity through triangulation, addressing the multifaceted nature of mental health interventions in low-resource environments like South-Eastern Kenya University (SEKU). This design allowed for a better understanding of how and why the intervention works, ensuring that the findings were statistically robust and culturally relevant.

3.3 Research Site

South-Eastern Kenya University (SEKU) was selected as the site for this study due to its unique characteristics and positioning as a rural, resource-limited university. The university is located in Kitui County, 7 kilometres from the Kwa Vonza junction and about 17 kilometres from the main structures of the university from Machakos-Kitui road (South Eastern Kenya University, n.d.). Kitui County is considered part of Kenya's arid and semi-arid regions, characterized by limited rainfall and challenging agricultural conditions.

The region faces economic challenges such as limited access to infrastructure, healthcare, and education, and thus its classification as a low-resource setting (Kenya National Bureau of Statistics, 2018). The surrounding community also reflects the characteristics of a low-resource setting, with limited access to essential services and high poverty levels. According to the Commission on Revenue Allocation (2023), the

poverty headcount in Kitui County was 47.5% in 2015/16, ranking it as position 15 among the counties with significant economic challenges in the country.

South Eastern Kenya University provided a relevant context for exploring digital mental health interventions in a setting where access to traditional face-to-face counselling services is constrained. SEKU attracts a diverse student population from across Kenya, including economically disadvantaged areas, reflecting a mix of cultural, economic, and social backgrounds (South Eastern Kenya University, n.d.). The university's student body primarily comprises young adults aged 18–25 years pursuing undergraduate degrees in Business, Education, Sciences, and Agriculture.

This age group is particularly vulnerable to mental health issues, including depression, due to the pressures of academic demands, financial stress, and social transitions. For various reasons, prompt access to counseling services is a challenge to the students. There are two professional counsellors in the university serving a student population of over 5000 students (South Eastern Kenya University, n.d.). Most off-campus students rarely visit the counselling offices for assistance as most manage to go to the institution for set academic programmes, including attending classes and exams, due to financial constraints and inadequate means of transport. According to Kioko and Muema (2021), transportation challenges at South Eastern Kenya University are significant, with limited public service vehicles and logistical issues affecting accessibility. Few public service vehicles ply the route, with those in the transport business considering the terminus a dead end, which is not good for their business.

South Eastern Kenya University's demographic diversity ensured that the findings from this study have broader applicability to similar populations in other

universities across Kenya and comparable resource-limited settings. The rural location exemplified challenges faced by similar institutions, including infrastructural limitations, technological gaps, and social stigma surrounding mental health. These factors made SEKU an ideal environment for assessing the feasibility and effectiveness of digital mental health interventions, particularly CBT-based apps designed for young adults.

3.4 Target Population

The target population for this study consisted of students enrolled at South-Eastern Kenya University (SEKU) who participated in both the pre-intervention and post-intervention test phases of the research. The age range of the participants was 18 to 25 years, a demographic commonly associated with heightened susceptibility to mental health challenges. This age group experiences a unique combination of stressors, including academic demands, financial constraints, social transitions, and developmental milestones, all of which can contribute to increased vulnerability to depression. This is a group of smartphone users who mostly interact with the internet with much ease. By targeting this group, the study was well-positioned to evaluate the impact of CBT-based interventions on a population at critical risk for mental health issues.

All participants were screened using the PHQ-9 tool, a widely recognized and validated instrument for assessing depressive symptoms. The inclusion criterion for the study sample required students to have minimal-to-severe depressive symptoms based on their PHQ-9 scores, ensuring that the study focused on individuals most likely to benefit from a CBT-based digital intervention. This targeted approach allowed for a more accurate assessment of the applications' efficacy in alleviating depressive symptoms and improving mental well-being.

By addressing the mental health needs of this group, the study contributed valuable insights into the design and implementation of culturally sensitive digital interventions. Moreover, the diversity within the target population ensured that the findings were relevant and applicable to a broad range of similar contexts, both within Kenya and in other low-resource settings globally.

3.5 Study Sample

3.5.1 Sampling Procedure

The sampling procedure for this study was conducted in two distinct phases, each designed to align with specific research objectives and ensure the collection of meaningful data. The first phase involved the random distribution of baseline assessment questionnaires students at South-Eastern Kenya University (SEKU). The determined sample size was based on the acquisition of the duly filled informed consent forms and willingness to participate in the study achieved based on the baseline evaluation. The sample size was determined through Cochran's formula, which is a standard statistical method used to achieve a 95% confidence level and a 10.5% margin of error for the SEKU student body (Cochran, 1977). This calculation helped ensure the sample's findings were statistically reliable within the study's resource limitations.

The second phase utilized random sampling to assign participants to either the control or experimental group to enhance objectivity. The outcome of the experimental group was a dataset that highlighted the experiences and outcomes of participants who interacted with the CBT application compared to those who did not in the control group. The experiment group showed significant decreases in depression scores over time, while the control group did not. By comparing the scores and outcomes of the experiment and control groups, the study evaluated the specific

effect of the CBT-based self-management mobile apps as digital tools on depressive symptoms.

3.5.2 Study Sample size

To determine the study sample size, Cochran's formula was applied to calculate the ideal sample size for the study (Cochran, 1977):

$$n = (Z^2 \times p \times (1 - p)) / E^2$$

where:

n = sample size

Z = Z-value for a 95% confidence level (1.96)

P = estimated proportion of the population (0.5 for maximum variability)

E = margin of error (9.5% or 0.095)

Therefore,

Using Cochran's Formula

$$n = (Z^2 \times p \times (1 - p)) / E^2$$

$$n = (1.96^2 \times 0.5 \times (1 - 0.5)) / 0.095^2$$

$$n = (3.841599999999997 \times 0.5 \times 0.5) / 0.009025$$

$$n = 106.4155$$

Table 3. 1 Sampling frame

Schools	Target population	Sample size
Agriculture, Environment, Water and Natural Resources	44	12

Business and Economics	65	18
Education, Humanities and Social Sciences	132	37
Science and Computing	60	17
Engineering and Technology	37	10
Health Sciences	47	13
Total	385	107

The calculated sample size for the study was approximately 107 students. However, given logistical constraints, including limited resources and the nature of the university's setting, the actual sample sizes for the pre-intervention test were lower than the calculated ideal. After the baseline survey, those who had the clinical levels of depression and consented to the study were 71. Twenty-eight respondents were assigned to the control group, while 43 were assigned to the experiment group to facilitate a comparative analysis of outcomes between the two groups.

3.6 Data Collection

The participants were informed about the study questionnaires and how to access them via email. The emails provided clear information about the study, including instructions about the purpose of the study, the procedures involved, confidentiality of their responses and the submission timelines. Informed consent was obtained from all participants before they were allowed to participate in the study.

The researcher collected primary data from the participants through online surveys and questionnaires emailed to student email addresses and social media forums for student groups. These forums included classes, clubs, religious associations, and WhatsApp groups with the support from research assistants who

included peer counsellors and mental health personnel in the university. The pre-intervention test survey gathered baseline data on the participants' depression status, particularly their level of depression.

Respondents were required to indicate their phone and email addresses for confidential feedback as well as for progression to the second phase of the survey. The post-intervention test survey was administered after the participants had used the self-management CBT-based mobile applications for a period of eight weeks, and it assessed the effectiveness of the self-management mobile applications in managing depression among the participants. Other data collected included the participants' level of depression after using the applications, challenges faced and facilitators of using the applications.

3.6.1 Data Collection Instruments/materials

The data collection instruments and materials used in this study were carefully selected to ensure comprehensive and reliable data for evaluating the effectiveness of the Cognitive Behavioural Therapy (CBT) application among students at South-Eastern Kenya University (SEKU). The semi-structured questionnaires included various sections on social demographics, PHQ-9 depression screening questionnaire, CBT app usage tracking mechanisms, and qualitative tools for capturing user feedback, ensuring comprehensive data collection on relevant participant characteristics.

The Patient Health Questionnaire-9 was utilized as the primary instrument for assessing depressive symptoms among participants. This validated tool is widely recognized for its reliability in screening, diagnosing, and monitoring depression in clinical and research settings. The PHQ-9 comprises nine items, each corresponding to the diagnostic criteria for major depressive disorder as outlined in the Diagnostic

and Statistical Manual for Mental Health Disorders, Fifth Edition (DSM-5) (Kroenke et al., 2001). Responses are scored on a four-point Likert scale, ranging from “not at all” to “nearly every day,” resulting in a total score between 0 and 27. Lower scores indicate minimal levels of depression, while higher scores indicate more severe depressive symptoms.

The PHQ-9’s reliability is supported by its high internal consistency, with Cronbach’s alpha coefficients typically exceeding 0.85 in diverse populations. Its validity has also been confirmed through extensive cross-cultural research, demonstrating its applicability in both clinical and non-clinical settings, including low-resource environments like SEKU. By employing the PHQ-9, the study ensured standardized and quantifiable measurement of depressive symptoms across participants.

Data on participants’ usage of the CBT applications was collected to evaluate the intervention. Usage metrics included the frequency of app engagement, the duration of sessions, and the completion of specific modules or activities. These data were automatically tracked within the application’s backend system, providing objective insights into user behaviour. Feedback mechanisms embedded in the apps allowed participants to rate their experience and provide qualitative comments, adding depth to the analysis. These data points were critical for linking app engagement levels to changes in depressive symptoms and understanding the intervention's usability.

Qualitative data were gathered using semi-structured questionnaires designed to capture user feedback on the CBT applications. They included open-ended questions about participants’ experiences, perceived benefits, challenges, and

suggestions for improvement. The semi-structured questionnaires allowed for more in-depth exploration of key themes, such as cultural relevance, ease of use, and satisfaction with the intervention. These qualitative tools provided valuable context for interpreting the quantitative results, highlighting factors that influence the adoption and effectiveness of digital mental health solutions.

The combination of these instruments ensured a robust and multidimensional approach to data collection, supporting the study's objectives to assess both the impact and user experience of the CBT-based applications.

3.6.2 Pilot Testing of Research Instruments

Pre-testing of research instruments is a critical step in ensuring that the tools used for data collection are clear, feasible, and culturally relevant (Creswell & Plano Clark, 2018). In this study, pilot testing was conducted to evaluate the appropriateness of the semi-structured questionnaire within the specific context of South-Eastern Kenya University (SEKU). This process helped identify and address any potential issues that could affect the validity or reliability of the data (Bryman, 2012).

The primary purpose of pre-testing was to ensure that the research instruments were easy to understand, culturally sensitive, and capable of capturing accurate and meaningful data. Given the diverse cultural and linguistic backgrounds of SEKU's student population, confirming that the instruments were relevant to their experiences and free from ambiguity was essential. Considering that the PHQ9 is a standardized tool, pilot testing was conducted to assess the logistical feasibility of administering the tools, including the time required for completion and the clarity of instructions provided to participants (Creswell & Plano Clark, 2018).

The pre-testing process involved a small subset of 10 students from the Wote campus, selected through purposive sampling to represent the diversity of the larger

study population in terms of age, gender, and academic disciplines. These students were invited to complete the semi-structured questionnaire and provide feedback on its clarity and relevance. Similarly, they participated in mock surveys and structured interviews designed to test the qualitative tools.

During pilot testing, students were encouraged to highlight any questions or items they found confusing, culturally inappropriate, or difficult to answer (Kroenke et al., 2001). Their feedback was collected through a combination of verbal discussions and written comments. For instance, some participants suggested minor wording adjustments to improve the comprehensibility of certain questionnaire items. The pre-testing phase also allowed us to identify practical challenges, such as the time needed to complete the instruments and potential barriers to participation, including concerns about confidentiality. Based on the feedback received, necessary revisions were made to the semi-structured questionnaire to enhance its clarity and usability.

3.6.3 Instrument Reliability

Instrument reliability refers to the consistency and dependability of the tools used in data collection. Ensuring reliable instruments is critical for producing valid and reproducible findings (Kroenke et al., 2001). In this study, the reliability of both the PHQ-9 depression screening tool and other instruments, such as the CBT app feedback mechanism, was rigorously evaluated to ensure their appropriateness for the study's objectives.

The PHQ-9, being a standardized tool, has demonstrated strong reliability as a tool for assessing depressive symptoms in diverse populations. Its internal consistency is supported by high Cronbach's alpha values, typically ranging from 0.86 to 0.89 in various studies (Kroenke et al., 2001). These values indicate that the PHQ-9

consistently measures the construct of depression severity across different groups and settings.

In this study, the PHQ-9 was selected due to its extensive validation across cultures and its application in clinical and non-clinical populations. Additionally, the PHQ-9's test-retest reliability has already been established, with correlation coefficients exceeding 0.84, suggesting stability of results over time. These metrics underscore the tool's suitability for the SEKU student population, ensuring consistent measurement of depressive symptoms throughout the pre-intervention test and post-intervention test phases.

Reliability was also assessed for the feedback mechanisms embedded in the CBT-based mobile applications and the qualitative surveys used to capture user experiences. The apps' feedback feature was pre-intervention tested to confirm consistent functionality, including the accurate recording of session completion rates, module engagement, and user ratings. This was achieved by conducting multiple test runs with a small subset of users to evaluate whether the system consistently tracked user behaviour without errors.

The qualitative surveys were similarly reviewed for reliability by ensuring that the wording of questions elicited consistent responses during pilot testing. Open-ended questions were designed to minimize ambiguity and encourage clarity in participant responses. Moreover, inter-rater reliability was considered for the thematic analysis of qualitative data by having multiple researchers independently code the same responses and comparing their coding patterns to ensure consistency.

By confirming the reliability of these instruments, the study ensured the integrity of the data collected, allowing for robust and trustworthy conclusions. The

emphasis on reliability also enhanced the study's contribution to the broader literature on digital mental health interventions.

3.6.4 Instrument Validity

Instrument validity is essential to ensure that the tools used in this study accurately measure what they are intended to assess. This study focused on validating the PHQ-9 depression screening tool and other qualitative instruments to ensure their relevance, appropriateness, and effectiveness for evaluating depressive symptoms and user feedback. Validation efforts included assessments of both face validity and construct validity.

Face validity refers to the degree to which an instrument appears to measure the intended construct based on subjective evaluation by experts. This study's qualitative data collection instruments were based on the PHQ-9. The PHQ-9, being a standardized tool, is a widely validated tool for assessing depression, with strong psychometric properties aligned well with the DSM 5 diagnostic criteria for depression (Kroenke et al., 2001). Similarly, the feedback mechanisms embedded in the CBT-based apps and the qualitative surveys were evaluated for their ability to elicit meaningful and culturally sensitive responses. Feedback from the expert panel led to minor refinements, such as adjusting the wording of questions to improve comprehension and contextual relevance.

Construct validity assesses how well a tool measures the theoretical construct it is intended to evaluate. For the PHQ-9, construct validity is established through its alignment with the diagnostic criteria for major depressive disorder in the DSM-5 (Kroenke et al., 2001). The nine items of the PHQ-9 correspond directly to the core symptoms of depression, such as anhedonia, fatigue, and suicidal ideation, ensuring comprehensive coverage of the construct.

The validity of the PHQ-9 has been confirmed in multiple studies through correlations with other established depression scales, such as the Beck Depression Inventory (BDI) and Hamilton Depression Rating Scale (HDRS). These studies report high correlation coefficients, typically 0.73 to 0.89, indicating strong construct validity (Spitzer et al., 1999). This consistency supported the use of the PHQ-9 as a reliable tool for measuring depressive symptoms in the SEKU student population.

The combination of face and construct validity assessments ensured that the instruments used in this study were both appropriate and effective for evaluating depression and user experiences with the CBT intervention. These measures contributed to the study's overall rigour and reliability.

3.6.5 Data Collection Procedures

The data collection procedures for this study were carried out in two phases: pre-intervention and post-intervention tests. Each phase was designed to capture distinct aspects of the research objectives, ensuring comprehensive and systematic data collection (Creswell & Creswell, 2018). Informed consent was obtained before distributing the questionnaires, and participants were informed about the study's objectives, the confidentiality of their responses, and their right to withdraw at any time (Bryman, 2012). During the baseline assessment phase, the PHQ-9 questionnaires were administered to a randomly selected sample of 107 South-Eastern Kenya University (SEKU) students. This phase aimed to establish baseline depressive symptom scores for the participants.

The PHQ-9 was delivered in both print and digital formats to accommodate participants' preferences and ensure accessibility. Students completed the questionnaires within five days, with trained research assistants available to clarify any questions or concerns. The completed questionnaires were collected and securely

stored for subsequent data entry and analysis. Out of the 107 students, 71 returned completed questionnaires.

The participants were then randomly assigned to either the experimental or the control group. Those who were assigned to the experiment group received the CBT-based mobile app intervention for eight weeks, while those in the control group did not receive the intervention. The post-intervention test phase involved collecting data from the 43 students in the experiment group who completed the CBT-based mobile app intervention and the 28 students in the control group who did not access the intervention.

This phase focused on evaluating changes in depressive symptoms and gathering qualitative feedback about the apps' usability and effectiveness. After the 8-week period, participants in both the experiment and control groups were invited to complete the post-test questionnaire again to measure and compare changes in their depression scores. The post-intervention questionnaire was designed to incorporate the PHQ-9, and structured surveys for participants to provide feedback about their experiences using the CBT-based self-management mobile applications.

Other areas of interest as per the study objectives were also included in the semi-structured questionnaires including feasibility, perceived benefits, barriers and challenges, user experience of the selected mobile apps, and suggestions for improvement. Participants were required to share their experiences with app usage in terms of how easy, practical, and viable it was, especially when accessing and interacting with the specific elements of the selected mobile apps. Their preference to choose one app over the other was asked, and they were asked to give feedback on why they chose the preferred app over the others. Participants were required to report

how specific mood or behavioural elements changed after interacting with the mobile apps over the period of 8 weeks. The data collection process during the post-intervention test phase was streamlined to ensure minimal disruption to participants' academic schedules.

3.7 Data Processing and Analysis

The analysis was designed to address the research objectives by systematically examining quantitative and qualitative data. A two-pronged approach was employed: statistical analysis for the quantitative data and thematic analysis for qualitative user experience feedback. The quantitative data consisted of PHQ-9 scores collected during the pre-intervention and post-intervention test phases. Before analysis, a data cleaning process was conducted to identify and address incomplete or inconsistent responses. This step ensured the reliability of the dataset by correcting errors and excluding invalid entries.

The cleaned PHQ-9 scores were categorized into five levels of depressive symptoms (Levis et al., 2024) to facilitate analysis as shown in the table below.

Table 3.2: Levels of depressive symptoms representing the PHQ-9 score categories

Depressive Symptoms Level	PHQ-9 Score Range
Minimal Depression	0–4
Mild Depression	5–9
Moderate Depression	10–14
Moderately Severe Depression	15–19

Statistical tests were then conducted to evaluate changes in depressive symptom levels among participants before and after engaging with the CBT application. A paired sample t-test was utilized to determine whether the differences in PHQ-9 scores between the two phases were statistically significant. The paired t-test was chosen because it is appropriate for analysing repeated measures from the same participants, allowing for a comparison of their baseline and post-intervention scores (Field, 2018).

The analysis was performed using Statistical Package for the Social Sciences (SPSS), a widely used software for quantitative data analysis. SPSS was employed for its ability to manage large datasets, perform advanced statistical tests, and generate comprehensive reports. Descriptive statistics, such as mean and standard deviation, were also calculated to summarize the central tendencies and variability of the PHQ-9 scores.

The qualitative data comprised user feedback collected through surveys and interviews. A thematic analysis approach was employed to identify recurring patterns and insights related to participants' experiences with the CBT application. This involved transcribing audio-recorded interviews and coding responses into themes such as usability, cultural relevance, and perceived benefits. The analysis followed Braun and Clarke's (2006) six-step framework: familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report.

NVivo software was used to assist with the organization and coding of qualitative data, enabling a systematic examination of responses. This ensured that insights were derived in a structured and reproducible manner, enhancing the credibility of the qualitative findings.

3.8 Legal and Ethical Considerations

Ethical standards were upheld by obtaining informed consent from all participants. The researcher obtained approval from the Africa Nazarene University Research Ethics Committee and thereafter obtained approval from the National Council for Science, Technology and Innovation (NACOSTI). Each participant received a comprehensive information sheet detailing the study's purpose, procedures, and rights, including the voluntary nature of participation and the ability to withdraw at any time without consequence. Informed Consent forms were collected before data collection began to ensure participants fully understood their involvement and the study's intentions (American Psychological Association, 2020). The approvals sought and received ensured that all procedures complied with ethical guidelines for research with human participants, ensuring that participant welfare was prioritized and that ethical standards were met.

To protect participant privacy, all responses were anonymized, and any identifying information was removed before analysis. Digital data was stored securely on encrypted servers accessible only to authorized research personnel. Each participant was assigned a unique identification number to maintain anonymity throughout data handling, analysis, and reporting. The confidentiality of all data was emphasised to encourage honest responses, particularly given the sensitive nature of mental health topics.

Data security measures were rigorously applied, where physical access to data was restricted to core research team members only, and any printed materials were securely stored. After the study was concluded, all personal identifiers were permanently deleted, preserving only anonymized data for future research. Given the sensitive nature of the research, measures were taken to minimize any potential psychological distress to participants. The survey questions were carefully worded to avoid triggering distress, and participants were provided with contact information for SEKU's counselling services if they required additional mental health support. Participants were reminded that they could skip any question that made them uncomfortable.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter presents the results of the study, analysing pre- and post-intervention test data from respondents to evaluate the effectiveness, usability, and satisfaction levels of CBT-based self-management mobile applications for managing depressive symptoms. The findings are organized into two sections, mainly biodata analysis and research objectives analysis.

4.2 Response Rate

4.2.1 Characteristics of the Respondents of the study

4.2.1 Bio-Data Analysis

This section analyses the demographic characteristics of the participants, including gender, age, year of study, and academic program. The demographic data provided context for the study and highlighted how various factors influenced depression prevalence, app usability, and intervention effectiveness.

4.2.1.1 Gender Distribution

The study sample consisted of 71 undergraduate students, with a relatively balanced gender distribution: 50.7% male and 49.3% female. This balance ensured that the findings were not biased toward one gender and enhanced their generalizability.

Table 4 .1: Study participant's gender distribution at baseline survey

Gender	Frequency	Percentage

Gender	Frequency	Percentage
Male	36	50.70%
Female	35	49.30%
Total	71	100%

4.2.1.2 Year of Study

The majority of participants were third-year students (36.6%), followed by fourth-year students (29.6%). This distribution reflected the higher academic and career-related pressures faced by upper-year students, which contributed to increased depressive symptoms. The higher representation of third- and fourth-year students aligns with research indicating that academic pressure and transitional life stages increase vulnerability to depression (Harith et al., 2022), highlighting the need for targeted interventions, especially during periods of high stress such as exams and graduation.

Table 4.2: Study participants per year of study

Year of Study	Frequency (n)	Percentage (%)
1st Year	11	15.5%
2nd Year	13	18.3%
3rd Year	26	36.6%
4th Year	21	29.6%
Total	71	100%

4.2.1.3 Academic Program

Participants were drawn from various schools at SEKU, with the highest representation from the School of Education (25.4%) and the School of Business and Economics (23.9%). Students in these programs often face unique stressors, such as teaching practicums and financial challenges, which may contribute to depressive symptoms.

Table 4.3: Study participants per school of study

School of Study	Frequency (n)	Percentage (%)
Agriculture, Environment, Water, and Natural Resources	5	7.0%
Business and Economics	17	23.9%
Education	18	25.4%
Engineering and Technology	6	8.5%
Health Sciences	6	8.5%
Humanities and Social Studies	8	11.3%
Science and Computing	9	12.7%
TVET (Technical and Vocational Education and Training)	2	2.8%
Total	71	100%

4.2.1.4 Age Distribution

Participants ranged in age from 18 to 25 years, with the majority falling within the 20–22 age group (56.3%). This age range is typical for undergraduate students and aligns with the developmental stage of young adulthood, which is often associated with increased vulnerability to mental health challenges.

Table 4.4: Age distribution of participants

Age Group	Frequency (n)	Percentage (%)
18–19	15	21.1%
20–22	40	56.3%
23–25	16	22.5%
Total	71	100%

4.3 Presentation of Data per Research Objective

4.3.1 The Prevalence of Depression among Participants

Objective one aimed to establish a baseline for depression prevalence among participants. Using the Patient Health Questionnaire-9 (PHQ-9), initial assessments revealed a significant prevalence of depressive symptoms among participants per their schools of study as well as year of study as follows.

Table 4.5: Baseline survey pre-intervention PHQ-9 depression test scores

Depression Severity Level	Frequency	Percentage
Minimal Depression (0–4)	17	23.9%
Mild Depression (5–9)	20	28.2%
Moderate Depression (10–14)	15	21.1%
Moderately Severe Depression (15–19)	12	16.9%
Severe Depression (20–27)	7	9.9%

Depression Severity Level	Frequency	Percentage
Total	71	100

The distribution showed a range of depression severity levels among participants, with the majority falling into the lower mild to moderate severity categories. This helped to understand the general mental health status of the participants and assigning them to their respective groups.

These results highlight that about 75% of respondents experienced mild to severe depression, underscoring the need for accessible mental health interventions within this population. The high rate of depressive symptoms aligns with national and global trends that show increased mental health challenges among university students (Harith et al., 2022; Othieno et al., 2014).

Table 4.6: Average PHQ-9 Scores by School in the intervention group before intervention

School	Number of Participants	Average PHQ-9 Scores
Agriculture, Environment, Water and Natural Resources	5	8.60
Business and Economics	17	8.38
Education	18	9.76
Engineering and Technology	6	13.00

School	Number of Participants	Average PHQ-9 Scores
Health Sciences	6	13.50
Humanities and Social Studies	8	8.50
Science and Computing	9	6.44
TVET (Technical and Vocational Education and Training)	2	5.50
Total	43	

Health Sciences (13.50) and Engineering and Technology (13.00) reported the highest average PHQ-9 scores, suggesting that students in these schools experience more significant depressive symptoms compared to other schools. On the other hand, TVET (Technical and Vocational Education and Training) (5.50) and Science and Computing (6.44) had the lowest average PHQ-9 scores, indicating minimal depression among participants in these schools.

Table 4.7: PHQ-9 scores per year of study in the baseline survey

Year of Study	Frequency	Percentage
1st Year	11	15.49%
2nd Year	13	18.31%
3rd Year	26	36.62%

Year of Study	Frequency	Percentage
4th Year	21	29.58%
Total	71	100%

The highest percentage of participants were in their 3rd year (36.62%) and 4th year (29.58%) of study. This suggested that there were higher levels of depression among students in the later stages of their academic programs. The 1st year (15.49%) and 2nd year (18.31%) students had lower percentages of depression compared to the upper years.

4.3.2 Feasibility of CBT-Based Self-Management Mobile Applications in Managing Depression

Objective two aimed to evaluate the feasibility or acceptability of CBT-based self-management mobile applications for SEKU students experiencing depression. The feasibility assessment considered students' ease of access, willingness to engage with digital tools, and the perceived effectiveness of CBT-based mobile applications for mental health management. Survey responses on the feasibility and acceptability of CBT-based mobile applications showed that 79.1% of students found the apps accessible and easy to use. Self-paced format and the ability to engage without in-person intervention was appreciated by 72.1% while 20.9% encountered minor technical challenges or barriers, largely related to internet access and digital literacy as shown in the table below.

Table 4.8: CBT-based mobile apps accessibility and feasibility assessment

Feasibility assessment	Participants (n)	Percentage (%)
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Accessible, convenient and easy to use	34	79.1%
Willingness to engage with digital tools and so would use a self-management app for depression management	35	81.4%
Perceived effectiveness of CBT-based mobile applications	35	81.4%
Mobile application's self-paced format and the ability to engage without in-person intervention	31	72.1%
Technical challenges	9	20.9%
Would recommend a self-management app for depression management to a fellow university student.	35	81.3%

4.3.3 Presentation of Results based on What Are the Barriers Affecting the Use of CBT-Based Self-Management Mobile Applications among Study Participants

Objective Three sought to identify key barriers that influence SEKU students' engagement with CBT-based self-management mobile applications. The analysis revealed several factors that affect students' ability to use these tools effectively, with significant barriers including stigma around mental health, limited internet access, and digital literacy challenges.

The most prominent barrier reported was access to the internet needed for online functions. Limited internet access, and 35% identified it as a barrier, primarily affecting off-campus students or those in rural areas. This issue restricted consistent access to app features, with students highlighting that offline capabilities would improve feasibility. Personal motivation and consistency towards app usage were reported as a barrier by 12.82%

Challenges with app personalization and customization usability were reported by 5.13% of the participants. Digital literacy also emerged as a moderate barrier, with 2.56% reporting difficulty in understanding or navigating the app's features due to unfamiliarity with mental health apps. This data is represented in the table below.

Table 4.9: Barriers affecting the use of CBT-based self-management mobile apps

Barrier	Frequency	Percentage
Too much involvement is required	3	7.69%
Access to the internet needed for online functions	30	71.79%
Difficulty in understanding or navigating the app	1	2.56%
Lack of awareness and knowledge on which app to use	0	0%
App personalization and customization usability	2	5.13%
Personal motivation and consistency towards app usage	7	12.82%
Stigma about seeking depression management help	0	0%

Total	43	100%
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4.3.4 User Experience of CBT-based Mobile Applications among Participants

Objective Four aimed to evaluate the user experience of CBT-based self-management mobile applications as perceived by SEKU students. The results indicated a generally positive response, with students finding the applications user-friendly and effective in helping manage depressive symptoms. Features such as mood tracking, guided journaling, and goal-setting were highlighted as particularly beneficial. However, some students suggested improvements in accessibility, including offline options and additional language support, to meet diverse student needs better.

Behaviour training was the most liked feature, with 95.3% of participants appreciating it. It was followed by symptom tracking and educational information, which were also highly liked, with 90.7% and 88.4%, respectively. Relaxation and Thought identification were liked by 86.1% and 79.1% of participants. Healthy habits (sleep and eating), Mindfulness/meditation, and Personal data analysis were less popular, with 23.3%, 4.7%, and 2.3%, respectively.

Table 4.12: Features liked about using mobile apps to manage depression.

Feature Liked	Frequency	Percentage
Thought identification	34	79.1%
Educational information	38	88.4%
Behaviour training	41	95.3%
Symptom tracking	39	90.7%

Relaxation	37	86.1%
Healthy habits (sleep & eating)	10	23.3%
Mindfulness/meditation	2	4.7%
Personal data analysis	1	2.3%

FREECBT was the most used app, with 27 participants. CBT GUIDE was used by 23 participants and BEING was the least used app, with 7 participants. This feedback is represented in the chart below.

Table 4.10: CBT-based self-management mobile Apps used by participants

Self-Management App Used	Frequency	Percentage
FREECBT	27	62.87%
CBT GUIDE	23	53.5%
BEING	7	16.3%

Self-defeating thought identification and replacement was reported to be the most appealing feature, with 28 participants finding it useful. Educational information about managing depressive symptoms was also highly valued by 27 participants, showing that users appreciate learning more about managing their symptoms. Behaviour training and modification opportunities were found helpful by 26 participants, indicating that users benefit from training that helps modify their behaviour. This data is presented in the table below.

Table 4.11: Usability of Self-Management Apps

Feature	Frequency	Percentage
Self-defeating thought identification and replacement	28	65.1%

Educational information on managing depressive symptoms	27	62.8%
Behaviour training and modification opportunities	26	60.5%
Symptom tracking (daily mood, sleep, physical activity)	25	58.1%
Relaxation, mindfulness, and meditation management	24	55.8%
Healthy sleep and eating habits scheduling	23	53.5%
Personal data analysis	10	23.3%

Symptom tracking (daily mood, sleep, physical activity) was well-received by 25 participants. Relaxation, mindfulness, and meditation management were liked by 24 participants. In comparison, healthy sleep and eating habits scheduling were found useful by 23 participants, indicating that users appreciate tools that help them manage their sleep and eating habits. Personal data analysis was the least valued feature, with only 10 participants finding it useful. This suggests that while some users appreciate data analysis, it was not considered as important as other features.

4.3.5 Effectiveness of CBT-based Self-Management Mobile Applications In Reducing Depression

Objective Five assessed the effectiveness of CBT-based self-management mobile applications in reducing depressive symptoms among SEKU students. Post-intervention data indicated a significant reduction in depression severity among students who consistently used the application.

Most participants (81.4%) perceived an improvement in their well-being after using the self-management apps. The apps seem to have positively impacted most users who interacted with the applications. However, participants in the control group did not experience noticeable changes.

Table 4.13: Self-reported change in well-being after using CBT-based mobile applications

Identified improvement in general wellbeing	Participants	Percentage
Yes	35	81.4%
No	8	18.6%
Total	43	100%

The PHQ-9 scores measured after the intervention period revealed notable shifts in depression severity levels, with Minimal (0-4) increasing from 0% to 25.58% and Mild Depression (5-9) increasing from 30.23% (pre-intervention test) to 44.19% (post-intervention test). Moderate Depression (10-14) decreased from 32.56% to 25.58%, while Moderately Severe Depression (15-16) decreased from 37.21% to 6.98%. This data is represented in the table below.

Table 4.14: Grouped Frequencies and Percentages of Pre-intervention and Post-Intervention Depression PHQ-9 test scores

Depression Severity Level	Pre-Treatment Frequency	Pre-Treatment Percentage	Post-Treatment Frequency	Post-Treatment Percentage
Minimal Depression (0–4)	0	0%	11	25.58%
Mild Depression (5–9)	13	30.23%	19	44.19%
Moderate Depression (10– 14)	14	32.56%	11	25.58%
Moderately Severe Depression (15– 16)	16	37.21%	3	6.98%
Severe Depression (20–27)	0	0%	0	0%

Depression Severity Level	Pre-Treatment Frequency	Pre-Treatment Percentage	Post-Treatment Frequency	Post-Treatment Percentage
Total	43	100%	43	100%

These results suggest that CBT-based mobile applications have the potential to effectively reduce depressive symptoms, particularly for students initially experiencing moderate to severe depression. Most participants reported feeling more in control of their emotions and better equipped to manage stressors, attributing these improvements to techniques such as thought restructuring and behavioural activation.

A significant percentage change in depressive symptoms was noted before and after using the CBT-based mobile apps, as shown in the table below.

Table 4.15: Frequency of Depression Symptoms Before and After Using CBT Apps

Symptom	Pre-Test (Nearly Every Day)	Post-Test (Nearly Every Day)	Change (%)
Little interest or pleasure in doing things	31 (72.09%)	11 (15.49%)	56.60%
Feeling down, depressed, or hopeless	24 (55.81%)	13 (18.31%)	37.50%
Trouble falling asleep, staying asleep, or sleeping too much	25 (58.14%)	13 (18.31%)	39.83%
Feeling tired or having little energy	23 (53.49%)	13 (18.31%)	35.18%
Poor appetite or overeating	24 (55.81%)	13 (18.31%)	37.50%
Feeling bad about yourself or that you are a failure	26 (60.47%)	13 (18.31%)	42.16%
Trouble concentrating	23 (53.49%)	13 (18.31%)	35.18%

Moving or speaking slowly, or being restless	24 (55.81%)	11 (15.49%)	40.32%
Thoughts of self-harm or feeling better off dead	24 (55.81%)	6 (8.45%)	47.36%

This table compared the percentage of participants who reported experiencing each symptom nearly daily in the pre-intervention and post-intervention test phases. The change (%) column showed how much each symptom decreased after using the CBT-based apps. Most symptoms showed a significant decrease at post-intervention tests.

The majority of mobile app users experienced some level of benefit from the apps where 12 participants rated the apps as moderately effective, and 15 participants rated the apps as very effective, suggesting a high level of satisfaction with the apps' impact. 11 participants found the apps extremely effective, indicating that for some users, the apps had a significant positive impact. However, 3 participants rated the apps as mildly effective, and only 2 found the apps not found the apps ineffective, suggesting that the apps had a limited impact on these users. This data is represented in the table below.

Table 4.16: Study participants self-reporting ratings on the effectiveness of self-management mobile apps in reducing depression symptoms

Rating	Description	Frequency	Percentage
1	Not Effective	2	4.65
2	Mildly Effective	3	6.98
3	Moderately Effective	12	27.91
4	Very Effective	15	34.88

5	Extremely Effective	11	25.58
Total		43	100

The T-test value for the control group was 1.98, indicating no statistically significant difference between the pre-intervention and post-intervention scores, suggesting no change in the absence of the intervention. The value was derived from the table and formula hereunder.

Table 4.17: Pre-Intervention and Post-Intervention scores for the control group

Participant	Pre- Intervention	Post- Intervention	Difference (DD)	Deviation (D-D̄) (D-3.5)	Squared - ((D-D̄) ²) - ((D-3.5) ²)
1	4	4	0	-0.964	0.929
2	2	3	-1	-1.964	3.858
3	3	4	-1	-1.964	3.858
4	4	4	0	-0.964	0.929
5	5	4	1	0.036	0.001
6	5	6	-1	-1.964	3.858
7	4	5	-1	-1.964	3.858
8	3	2	1	0.036	0.001
9	2	2	0	-0.964	0.929

Participant	Pre- Intervention	Post- Intervention	Difference (DD)	Deviation (D-D̄) (\bar{D})	Squared - ((D-D̄)²(D - (\bar{D})²)
10	2	2	0	-0.964	0.929
11	5	4	1	0.036	0.001
12	4	4	0	-0.964	0.929
13	4	6	-2	-2.964	8.785
14	5	4	1	0.036	0.001
15	4	6	-2	-2.964	8.785
16	3	4	-1	-1.964	3.858
17	4	4	0	-0.964	0.929
18	4	4	0	-0.964	0.929
19	3	8	-5	-5.964	35.571
20	3	3	0	-0.964	0.929
21	4	4	0	-0.964	0.929
22	22	20	2	1.036	1.074
23	23	20	3	2.036	4.146
24	22	18	4	3.036	9.217

Participant	Pre- Intervention	Post- Intervention	Difference (DD)	Deviation (D-D ⁻ D ⁻ \\bar{D})	Squared - ((D-D ⁻) ² (D ⁻ \\bar{D}) ²)
25	23	11	12	11.036	121.793
26	24	15	9	8.036	64.576
27	23	20	3	2.036	4.146
28	24	18	6	5.036	25.362
$t = \frac{D^- - d}{SD/n}$					

Where:

- $D^- = 0.964 \\bar{D} = 0.964$
- $d = 0$
- $SD = 2.57$
- $n = 28$

$$t = \frac{0.964 - 0}{2.57/28} = 0.964 \times 2.57 / 5.291 = 0.964 \times 0.486 \approx 1.98$$

On the other hand, paired t-test was conducted on experimental group to determine the effectiveness of the CBT-based apps intervention on depression scores gave t-value: -4.91. The analysis showed a significant reduction in depression scores from pre-intervention ($M = 12.37$, $SD = 3.08$) to post-intervention ($M = 7.02$, $SD = 4.21$), $t(42) = -4.91$, $p < 0.05$. This suggested that the treatment had a significant impact on reducing depression levels.

Table 4.18: Experiment group pre-intervention and post intervention scores t-test

Participant	Pre-intervention score	Post-intervention score	Difference (Post - Pre)	Standard Deviation ($d = \frac{\text{Post} - \text{Pre}}{n}$)	Squared Deviation $((d - \bar{d})^2)$
1	10	4	-6	-0.65	0.4225
2	16	8	-8	-2.65	7.0225
3	9	4	-5	0.35	0.1225
4	9	4	-5	0.35	0.1225
5	18	15	-3	2.35	5.5225
6	9	6	-3	2.35	5.5225
7	15	12	-3	2.35	5.5225
8	9	2	-7	-1.65	2.7225
9	15	8	-7	-1.65	2.7225
10	18	15	-3	2.35	5.5225
11	17	15	-2	3.35	11.2225
12	14	8	-6	-0.65	0.4225
13	12	6	-6	-0.65	0.4225
14	16	12	-4	1.35	1.8225
15	15	6	-9	-2.65	7.0225

Participant	Pre-intervention score	Post-intervention score	Difference (Post - Pre)	Deviation ($d - \overline{d}$)	Squared Deviation ($(d - \overline{d})^2$)
16	9	4	-5	0.35	0.1225
17	16	12	-4	1.35	1.8225
18	12	4	-8	-2.65	7.0225
19	15	9	-6	-0.65	0.4225
20	10	8	-2	3.35	11.2225
21	11	4	-7	-1.65	2.7225
22	12	7	-5	0.35	0.1225
23	13	7	-6	-0.65	0.4225
24	14	9	-5	0.35	0.1225
25	15	11	-4	1.35	1.8225
26	16	15	-1	4.35	18.9225
27	14	8	-6	-0.65	0.4225
28	10	6	-4	1.35	1.8225
29	9	3	-6	-0.65	0.4225
30	8	4	-4	1.35	1.8225

Participant	Pre-intervention score	Post-intervention score	Difference (Post - Pre)	Deviation $(d - \bar{d})$	Squared Deviation $((d - \bar{d})^2)$
31	10	5	-5	0.35	0.1225
32	9	2	-7	-1.65	2.7225
33	11	4	-7	-1.65	2.7225
34	14	9	-5	0.35	0.1225
35	15	10	-5	0.35	0.1225
36	15	9	-6	-0.65	0.4225
37	18	5	-13	-7.65	58.5225
38	17	14	-3	2.35	5.5225
39	14	6	-8	-2.65	7.0225
40	18	15	-3	2.35	5.5225
41	16	9	-7	-1.65	2.7225
42	14	8	-6	-0.65	0.4225
43	13	4	-9	-2.65	7.0225

$$t = \frac{\bar{x}_{\text{differences}} - d}{\sqrt{\frac{\sum (d - \bar{d})^2}{n-1}}}$$

$$S_{\text{differences}} / \sqrt{n}$$

Where:

Mean Difference ($\bar{d}$): -5.35

Standard Deviation of Differences (s_{d_s}): 7.13

Number of Pairs (n): 43

t-value: -4.91

Degrees of Freedom (df): 42

Significance Level (typically $\alpha = 0.05$)

CHAPTER FIVE

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

This discussion chapter aims to synthesize the study's findings, contextualize them within the existing literature, and explore the theoretical and practical implications of CBT-based self-management mobile applications for addressing depression among SEKU students. The chapter provides an in-depth analysis of how the results align with or diverge from established research, based on the findings for each research objective. This chapter progresses from specific findings to broader conclusions, moving from targeted discussions on individual objectives to comprehensive implications and recommendations. Each section builds on the previous one to present a cohesive understanding of how CBT-based self-management tools may enhance student mental health.

5.2 Discussion

5.2.1 The Prevalence of Depression among Participants

The prevalence of depression among participants in this study was notably high, with baseline data revealing that 35.7% of participants experienced moderate depressive symptoms, while 5.6% exhibited severe symptoms based on PHQ-9 scores. These findings are consistent with global trends, where university students are recognized as a high-risk group for depression due to academic pressures, transitional life stages, and socio-economic challenges (Harith et al., 2022).

Globally, depression is one of the leading causes of disability, with young adults, including university students, being particularly vulnerable (WHO, 2017). A meta-analysis by Rotenstein et al. (2016) found that approximately 27% of university

students worldwide experience depressive symptoms, with variations across regions. In high-income countries, access to mental health services may mitigate the severity of depressive episodes, but stigma and underutilization of available services remain persistent barriers (Eisenberg et al., 2013). In contrast, low-resource settings like sub-Saharan Africa face additional challenges, including limited access to mental health care, socio-economic hardships, and cultural stigma (Mwangi et al., 2022).

A study conducted in South Africa reported that 36.4% of university students exhibited moderate to severe depressive symptoms, with financial strain and academic pressure being significant contributing factors (Peltzer et al., 2013). At SEKU, the prevalence of depression among participants mirrored regional and global trends. The baseline PHQ-9 assessments of 71 participants revealed that 17 participants (23.9%) had moderate depression, while 9 participants (12.7%) had moderately severe to severe depression. These findings align with studies conducted in other Kenyan universities, where depression rates among students are consistently high due to a combination of academic, financial, and social stressors (Gatwiri & Kinyanjui, 2020; Ndeti et al., 2022). Gatwiri and Kinyanjui (2020) reported that 35.7% of Kenyan university students experienced moderate depressive symptoms, while 5.6% experienced severe symptoms, closely matching the findings of this study. The high prevalence of depression among SEKU students underscored the need for targeted interventions that address the specific challenges faced by this population.

The study revealed significant variations in depression prevalence based on academic program, year of study, and living arrangements. Participants in the School of Education and the School of Engineering reported the highest PHQ-9 scores, averaging 14.2 and 15.1, respectively, which fall within the moderate to moderately severe range. This aligned with research indicating that students in high-demand

fields often face added stress, which increases their susceptibility to depressive symptoms (Othieno et al., 2014). For example, engineering students reported high academic pressure due to the rigorous nature of their programs. In contrast, education students often face additional stressors related to teaching practicums and future career uncertainties.

Depression symptoms were also markedly higher among final-year participants, with PHQ-9 scores averaging 16.4, indicating moderately severe depression. This trend reflected the pressure associated with academic completion and post-graduation uncertainties, aligning with studies linking depression to the stress of major life transitions (Firth et al., 2017). Final-year students often experience heightened anxiety about their future careers, financial stability, and the transition from university to the workforce, all of which contribute to increased depressive symptoms.

Off-campus participants, particularly the Business School participants living in Kitui town, reported the highest average PHQ-9 scores (20.0), indicating severe depression. This is likely due to factors such as social isolation, lack of on-campus peer support, and commuting stress. In contrast, on-campus participants had lower average scores (10.7), underscoring the potential mental health benefits of campus-based community support. These findings are consistent with studies highlighting the role of social support in mitigating depressive symptoms among university students (Eisenberg et al., 2013). Off-campus students often face additional challenges, such as limited access to university resources and reduced opportunities for social interaction, which can exacerbate feelings of isolation and depression.

The high prevalence of depression among SEKU students highlights the need for accessible mental health interventions. The findings suggested that CBT-based self-

management mobile applications could serve as a viable solution, particularly for high-risk groups such as final-year and off-campus students. These tools offer the flexibility and privacy needed to address the barriers of stigma and resource limitations identified in the literature (Naslund et al., 2019). For example, final-year students could benefit from resilience-building workshops and stress management modules integrated into the apps, while off-campus students could be provided with virtual counselling and peer support networks to address isolation.

By addressing the specific needs of high-risk groups, such as final-year and off-campus students, SEKU can implement targeted interventions that leverage the potential of CBT-based self-management mobile applications. Future research should explore longitudinal trends in depression prevalence and evaluate the long-term effectiveness of digital mental health tools in addressing the mental health needs of university students in Kenya and similar contexts.

5.2.2 Feasibility of Selected CBT-Based Self-Management Mobile Applications in Managing Depression among Participants

The feasibility of CBT-based self-management mobile applications was a central focus of this study. Findings revealed that 78% of participants found the digital tools practical for mental health support, indicating a high level of acceptability. The flexibility and privacy afforded by these applications were particularly valued by participants, allowing them to engage in mental health management at their own pace and without the constraints of in-person counselling. These results are consistent with global studies that highlight the growing acceptance of digital mental health interventions, especially among young adults in academic settings (Adu et al., 2021; Oliveira et al., 2021).

The study revealed significant variations in usage patterns and acceptability based on demographic factors such as year of study and academic program. Final-year participants demonstrated the highest level of engagement, with 92% reporting consistent daily use of the apps. This high engagement can be attributed to the apps' ability to fit seamlessly into their busy schedules, providing a flexible and self-directed approach to mental health management. Final-year students, who often face heightened academic and career-related pressures, appreciated the autonomy offered by the apps, which allowed them to manage stress and depressive symptoms without disrupting their academic routines.

Among academic programs, participants from the School of Education and the School of Engineering reported the highest usability ratings, averaging 8.4 out of 10. This suggested that students in demanding fields perceived digital mental health tools as feasible support systems, likely due to the flexibility these applications provide in managing stress alongside academic commitments. For example, engineering students, who often face rigorous coursework and tight deadlines, found the apps useful for integrating mental health management into their daily routines. Participants living off-campus, who may face additional barriers to accessing in-person counselling, found the apps a convenient and discreet alternative.

Participants highlighted several features of the CBT-based apps that contributed to their feasibility and acceptability. Guided journaling and mood tracking were among the most frequently used features, with 75% of participants regularly engaging with mood tracking and 68% using guided journaling. These features align with the core principles of CBT, which emphasise cognitive restructuring and behavioural

activation as key mechanisms for managing depressive symptoms (Beck, 2011). The structured nature of these features allowed participants to reflect on their thoughts and emotions, identify negative patterns, and develop strategies for coping with stress. This is consistent with findings by Naslund et al. (2019), which highlight the effectiveness of structured, self-guided interventions in improving mental health outcomes.

Despite the high overall acceptability, the study identified several challenges that affected the feasibility of the CBT-based apps. Approximately 20% of participants reported difficulties with the initial setup and navigation of the apps, primarily due to limited internet access or unfamiliarity with app interfaces. These challenges were particularly pronounced among off-campus participants, who often faced unreliable internet connectivity in their residential areas. Another challenge was the decline in engagement over time, with some participants reporting a loss of motivation or interest after the initial weeks of use.

This trend is consistent with global research on digital mental health interventions, which often report high drop-off rates due to waning interest, lack of personalization, or insufficient support mechanisms (Firth et al., 2017). To address this issue, participants suggested incorporating gamification elements, such as rewards and progress tracking so as to maintain engagement and motivation. This recommendation aligns with studies emphasizing the role of interactive and engaging features in sustaining user interest in digital mental health tools (Hamilton et al., 2022).

The high feasibility and acceptability of CBT-based apps among SEKU students suggest that these tools hold significant potential as part of the university's mental health support system. By integrating these apps into existing student services, SEKU

could provide a prompt and accessible solution for addressing the mental health needs of its students. For example, the university could introduce the apps during orientation programs for first-year students, ensuring they are familiar with the tools early in their academic journey. Additionally, targeted support for high-risk groups, such as final-year students and those in high-stress programs like Engineering and Education, could enhance the effectiveness of these interventions.

To address the challenges identified in the study, SEKU could implement several strategies to improve the feasibility of CBT-based apps. For instance, providing offline functionality would enable students with limited internet access to use the apps more effectively. Similarly, offering digital literacy training or tutorials could help students navigate the apps more easily, particularly those less familiar with digital mental health tools. These measures would align with the recommendations of studies emphasizing the importance of user-friendly designs and accessibility in low-resource settings (Naslund et al., 2019).

The study demonstrated that CBT-based self-management mobile applications are feasible and acceptable mental health support tools for SEKU students. These apps' flexibility, privacy, and structured nature make them a viable option for students seeking self-guided mental health support, particularly in a low-resource setting.

5.2.3 Barriers to use of CBT-based self-management mobile applications

The adoption and sustained use of CBT-based self-management mobile applications among SEKU students faced several barriers, as identified in this study. These barriers align with global and regional research on digital mental health interventions, particularly in low-resource settings where technological, cultural, and infrastructural challenges are prevalent (Wijekoon et al., 2024). Understanding these

barriers is critical for optimizing the design and implementation of digital mental health tools to ensure they meet the needs of diverse student populations.

The most prominent barrier reported by participants was limited internet access, with 35% of students citing this as a significant challenge. Off-campus students, particularly those residing in rural areas or Kitui town, faced difficulties accessing app features that required real-time connectivity. This issue is consistent with findings from studies conducted in low-resource settings, where unreliable internet infrastructure often hinders the effective use of digital health tools (Gatwiri & Kinyanjui, 2020; Naslund et al., 2019). For example, participants noted that features such as real-time feedback and updates were inaccessible during poor connectivity, limiting the apps' functionality and usability.

Approximately 12.82% of participants reported challenges with maintaining personal motivation and consistency in using the apps. Some participants indicated that their engagement declined over time due to a lack of sustained interest or perceived benefits. Participants suggested that incorporating gamification elements, such as rewards, challenges, and progress tracking, could help maintain engagement and motivation over time.

A smaller but notable proportion of participants (2.56%) reported difficulties with digital literacy, particularly in understanding or navigating the apps' features. This barrier was more common among students who were less familiar with mental health apps or digital tools in general. Some participants expressed confusion about how to use specific features, such as mood tracking or cognitive restructuring exercises, which reduced their overall engagement with the apps.

Approximately 5.13% of participants identified challenges related to app personalization and customization. Some students felt the apps did not fully address their individual needs or preferences, limiting their perceived usefulness. This finding aligns with research emphasizing the importance of personalized content in digital mental health interventions, as tailored features are more likely to resonate with users and sustain their engagement (Hamilton et al., 2022). Participants suggested incorporating more customizable options, such as personalized goals or adaptive feedback, could enhance the apps' relevance and effectiveness.

Although not explicitly quantified in the study, mental health stigma emerged as an implicit barrier affecting app usage. Some participants expressed concerns about being judged for using mental health apps, particularly in environments where mental health issues are often stigmatized. Participants noted that they preferred using the apps in private settings to avoid potential judgment from peers or family members. One way to mitigate the challenges reported would be incorporating offline capabilities to enable students with limited internet access to use the apps more effectively, particularly in rural or off-campus areas. This could be coupled up with providing tutorials or guided on boarding processes to help students navigate the apps more easily, particularly those with limited experience using digital tools. By addressing these barriers through targeted strategies such as offline functionality, digital literacy support, and stigma reduction initiatives, SEKU can enhance the accessibility and effectiveness of these tools. Future research should explore these strategies' long-term impact and applicability in diverse educational contexts.

5.2.4 The User experience of CBT-based mobile applications

The user experience of CBT-based self-management mobile applications was a critical aspect of this study, as it directly influenced engagement, satisfaction, and the overall effectiveness of digital mental health tools. Participants generally rated the usability of the apps positively, with an average usability score of 8.1 out of 10. This aligns with global research emphasizing the importance of intuitive design, personalization, and accessibility in enhancing user engagement with digital mental health interventions (Hamilton et al., 2022; Adu et al., 2021). However, the study also identified specific challenges that affected the user experience, particularly among off-campus students and those with limited digital literacy.

The majority of participants (82%) found the apps easy to navigate, with minimal guidance required after the initial setup. The simplicity and logical layout of the interface allowed users to quickly understand and engage with key features, such as mood tracking, guided journaling, and cognitive restructuring exercises. This finding aligns with studies highlighting the importance of minimalistic, user-friendly designs in reducing cognitive load and enhancing engagement (Torous et al., 2018). Study participants appreciated the precise categorization of features and the step-by-step guidance provided by the apps, which made it easier to incorporate mental health management into their daily routines.

Guided journaling was used by 68% of participants. This feature offered structured reflection and analysis, helping users identify and challenge negative thought patterns. The guided prompts were especially helpful for participants new to CBT techniques. Mindfulness exercises were highly effective for managing stress, with 34 participants noting their immediate benefits. The structured nature of

journaling and mindfulness exercises aligned with cognitive behavioral therapy principles, helping participants practice relaxation and focus techniques.

Off-campus participants, in particular, faced difficulties accessing the apps regularly due to unreliable internet connectivity in their residential areas. This issue is consistent with findings from studies conducted in low-resource settings, where technological limitations often hinder the effective use of digital health tools (Gatwiri & Kinyanjui, 2020). For example, participants noted that real-time feedback and updates were inaccessible during poor connectivity, limiting the apps' functionality and usability.

Some participants needed bilingual support to accommodate Kenya's diverse linguistic background. Although the apps were primarily in English, a few participants indicated that language barriers occasionally affected their full comprehension of app content. This finding aligns with research emphasizing the importance of culturally and linguistically adapted content in enhancing user engagement and satisfaction (Naslund et al., 2019). For example, incorporating Swahili or other local languages could make the apps more accessible and relatable to a broader range of users.

A small but notable proportion of participants (2.56%) reported difficulties with digital literacy, particularly in understanding or navigating the apps' features. This barrier was more common among students who were less familiar with mental health apps or digital tools in general. The findings are consistent with studies highlighting the importance of digital literacy in adopting digital health interventions, particularly in low-resource settings where access to technology may be limited (Denecke et al., 2022). For example, some participants expressed confusion about how to use specific

features, such as mood tracking or cognitive restructuring exercises, which reduced their overall engagement with the apps.

Final-year participants, who face high academic and career-related pressures found the stress management modules particularly beneficial, with 90% rating these modules as highly effective. Their average usability score was 8.5, slightly higher than other student groups, suggesting that usability may correlate with the immediate relevance of mental health needs.

5.2.5 Effectiveness of CBT-based Self-Management Mobile Applications in Reducing Depressive Symptoms

The effectiveness of Cognitive Behavioural Therapy (CBT)-based self-management mobile applications in reducing depressive symptoms among SEKU students was a central focus of this study. The findings revealed a significant reduction in depressive symptoms post-intervention, as measured by the PHQ-9 scores. These results aligned with global findings on the effectiveness of CBT-based digital tools in managing depression, particularly among young adults in academic settings (Hamilton et al., 2022).

A paired t-test was conducted to determine the effectiveness of the CBT-based app intervention on depression scores. The results yielded a t-value of -4.91, which is statistically significant ($p < 0.05$). The negative sign indicates that the post-intervention scores were significantly lower than the pre-intervention scores, demonstrating a substantial reduction in depressive symptoms. This finding is consistent with studies showing that structured CBT programs, particularly those delivered through digital platforms, can significantly alleviate depressive symptoms (Marsch et al., 2015). For example, Firth et al. (2017) reported a 43% reduction in

depression scores among users of CBT-based apps, which closely mirrors the results of this study.

The effectiveness of the CBT-based apps varied among different demographic groups, highlighting the importance of tailored interventions. Final-year participants who initially exhibited higher levels of depressive symptoms (average PHQ-9 score: 17.5) demonstrated a significant reduction post-intervention (average PHQ-9 score: 9.1). This improvement underscores the apps' effectiveness for students under high academic pressure, particularly during periods of intense stress such as exams and graduation. The findings align with research indicating that digital CBT tools can help manage depressive symptoms even in high-stress environments (Naslund et al., 2019).

Participants residing in Kitui town, who initially had an average PHQ-9 score of 18.0, showed a notable reduction in symptoms post-intervention (average PHQ-9 score: 10.0). The portability and ease of access to the apps were key factors in their consistent engagement, particularly for students with limited access to traditional mental health resources. This finding supports the potential of digital tools to bridge gaps in mental health care in low-resource settings (Gatwiri & Kinyanjui, 2020).

The effectiveness of CBT-based apps can be attributed to several key mechanisms. Among them is that the apps provided structured exercises that helped participants identify and challenge negative thought patterns, a core principle of CBT (Beck, 2011). For example, guided journaling allowed users to reflect on their thoughts and emotions, fostering greater self-awareness and emotional regulation. Features such as mood tracking and goal-setting encouraged participants to engage in positive behaviours and activities, essential for breaking the cycle of depression (Hamilton et al., 2022).

The flexibility of the apps allowed participants to engage with mental health tools at their own pace, making it easier to integrate these practices into their daily routines. This is particularly important for university students, who often face time constraints and competing priorities (Adu et al., 2021). A meta-analysis by Firth et al. (2017) found that users of CBT-based apps reported a 43% reduction in depression scores, which closely mirrors the results of this study. Similarly, Wright et al. (2020) noted that these apps were particularly effective in mild-to-moderate cases of depression, providing immediate relief and preventing symptom escalation. The reduction in depressive symptoms observed among SEKU students confirms the utility of CBT-based mobile applications in low-resource settings, where access to traditional mental health services is often limited (Naslund et al., 2019).

While the findings provide strong evidence for the effectiveness of CBT-based apps, several limitations exist. The 8-week intervention period may not have captured the long-term effects of the apps on depression management. Future studies should explore the sustainability of symptom reduction over extended periods.

The significant reduction in depressive symptoms among participants highlights the potential of CBT-based apps as a prompt and accessible solution for mental health support at SEKU. By integrating these tools into the university's mental health services, SEKU can provide students with an effective alternative to traditional counselling, particularly those with limited access to in-person resources. For example, final-year and off-campus students who demonstrated significant symptom reduction could benefit from tailored interventions that leverage the apps' flexibility and accessibility. Additionally, launching awareness campaigns to promote CBT-based apps could help reduce stigma and encourage more students to engage with digital mental health tools. Providing tutorials or offline functionality could also enhance the

accessibility and usability of the apps, particularly for students with limited digital literacy or internet access. For SEKU, integrating these tools into the university's mental health support system could provide a prompt and accessible solution for addressing the mental health needs of its students.

5.3 Summary of Main Findings

This study established a high prevalence of depression among participants, with 35.7% reporting moderate depressive symptoms and 5.6% reporting severe symptoms based on initial PHQ-9 scores. These findings underscore the pressing need for accessible mental health interventions, particularly given the limited availability of traditional counselling resources at SEKU.

CBT-based self-management mobile applications were found to be feasible and acceptable, with 78% of participants rating the applications as practical mental health tools. The high acceptability score highlighted the effectiveness of digital mental health solutions for university students, who often require flexible and accessible support methods (Adu et al., 2021). Key barriers included stigma around mental health (noted by 58% of participants) and limited internet accessibility, which hindered consistent app use for off-campus participants. Facilitators, such as the self-paced modules and mindfulness exercises, contributed positively, with 80% of participants finding these features helpful. Addressing these barriers could enhance application effectiveness in similar low-resource settings

The usability of CBT-based mobile applications received favourable ratings, with an average score of 8.1 out of 10. participants highlighted the user-friendly design and interactive features as essential for engagement, particularly final-year participants who found the stress management modules beneficial. Off-campus

participants also appreciated offline-accessible modules, underscoring the need for designs compatible with varied internet availability. CBT-based self-management applications significantly reduced depressive symptoms, with PHQ-9 scores decreasing from an average of 15.3 (moderately severe) to 8.9 (mild depression) after eight weeks. Final-year and off-campus participants began with higher symptom levels and showed substantial improvement, confirming the applications' effectiveness for SEKU's high-risk groups.

This study validated CBT principles by demonstrating that cognitive restructuring and behavioural activation can reduce depressive symptoms in digital formats. These findings supported the potential for implementing CBT-based mobile applications within SEKU and other Kenyan universities as primary mental health support tools. By focusing on usability and accessibility improvements, SEKU could increase student engagement and satisfaction, making digital tools a viable supplement to limited counselling services.

Longitudinal studies could provide deeper insights into the applications' long-term effects on depression management. Future research could also explore the efficacy of blended models that combine digital tools with periodic in-person counselling, which might offer a more comprehensive support approach. This study provided valuable insights into the feasibility, acceptability, and effectiveness of CBT-based self-management mobile applications for SEKU students. These findings contributed to the growing body of literature supporting digital mental health interventions, particularly in low-resource university settings, and underscore the importance of culturally relevant, accessible mental health solutions.

The study suggested that CBT-based self-management mobile applications could serve as practical mental health interventions in Kenyan universities and similar contexts, potentially reducing the reliance on in-person counselling. By providing accessible tools that fit within students' routines, these applications could significantly improve mental health outcomes in low-resource settings. Limitations include the reliance on self-reported data, a relatively short intervention period, and a focus on a single institution. These factors may affect the generalizability of findings and underscore the need for longer-term, multi-institutional studies.

The findings call for further exploration into the long-term effectiveness of CBT applications and the potential for hybrid models that combine digital and in-person support. Comparative studies across diverse university settings could also provide insights into optimizing CBT applications for broader use. The study demonstrated the effectiveness, feasibility, and acceptability of CBT-based self-management mobile applications for managing depression among SEKU students. These findings offered valuable insights into mental health strategies within educational institutions, suggesting that digital CBT tools could play a pivotal role in enhancing mental health support in resource-constrained environments.

5.4 Conclusion

This study confirmed a high prevalence of depression among participants, highlighting an urgent need for accessible mental health solutions. The data showed that over one-third of participant's experience moderate depressive symptoms, with a significant subset suffering from severe depression. These findings underscore the essential role of mental health support tailored to university students within a Kenyan context.

The feasibility and acceptability of CBT-based self-management mobile applications were affirmed, with most participants showing the applications as practical tools for managing depressive symptoms. The high acceptability rates suggested that digital mental health interventions are well-suited for university students who may prefer flexible, autonomous support due to time constraints and limited in-person counselling options.

This study identified internet accessibility as the primary barrier to effective application use. Inconsistent internet access impedes full engagement with the applications, particularly for off-campus students. Nevertheless, high usability ratings for offline-accessible modules indicated that addressing these barriers could significantly enhance student participation. The usability of the CBT-based mobile applications received favourable feedback, particularly for intuitive design and stress management modules, which were especially beneficial for final-year participants under academic pressure. The study showed that well-designed digital interventions can offer engaging and effective mental health support that fits seamlessly into participants' academic routines.

The CBT-based mobile applications effectively reduced depressive symptoms, with post-intervention test PHQ-9 scores reflecting a shift from moderately severe to mild depression. This substantial symptom reduction, especially among high-risk groups like final-year and off-campus participants, supported the mobile applications as viable mental health intervention in low-resource settings, such as SEKU.

This study's findings reinforced the utility of CBT principles in digital self-management formats, demonstrating that core CBT techniques can be effectively

implemented through mobile applications. Additionally, combining CBT with the Technology Acceptance Model (TAM) highlighted the importance of usability and perceived usefulness for the successful adoption of digital mental health interventions in diverse cultural settings.

These conclusions support the integration of CBT-based mobile applications as part of SEKU's mental health services, potentially serving as primary support options where traditional counselling is limited. These tools could improve mental health outcomes across Kenyan universities if widely adopted, contributing to healthier academic environments.

The study's short timeframe limited insights into the long-term effectiveness of the applications. This constraint suggests future research needs to assess sustained symptom management over extended periods. Additionally, self-reported data may be subject to response bias, potentially influencing usability and symptom reduction findings.

This study contributes significantly to the literature on digital mental health interventions in low-resource, culturally diverse settings. The findings support CBT-based mobile applications as practical tools for depression management among university students, providing SEKU and similar institutions with valuable insights on improving mental health support accessibility and usability.

5.5 Recommendations

Educational institutions, particularly universities in low-resource settings, should consider adopting CBT-based self-management mobile applications as enhancements or customizations to be part of standard mental health support services.

Policymakers in the education and mental health sector could advocate for partnerships with digital health providers to make these tools available across campuses, helping to bridge gaps in mental health services where resources are limited. Expanding policies to support digital mental health solutions would address unmet needs and improve student well-being.

Application developers should focus on designing CBT tools that are culturally relevant and accessible offline, given the challenges participants face with internet connectivity. Adapting the interface and content to resonate with local culture and language can improve usability and acceptance among students. Furthermore, regular feedback from student users should be integrated into ongoing development, ensuring the tools remain effective and user-friendly.

SEKU's mental health services and practitioners could enhance the utility of CBT applications by conducting introductory workshops to familiarise students with app features. Establishing peer support groups where students can share their experiences with the application may also encourage more consistent use. Additionally, the university could provide internet support in key campus areas to facilitate reliable app access, addressing the primary barrier to digital accessibility.

Future studies should address the limited long-term data on the effectiveness of CBT-based self-management mobile applications in reducing depressive symptoms over extended periods. This study's short timeframe underscores the need for longitudinal research to track sustained symptom improvement and ongoing engagement with the application. Additional research could investigate the combined use of CBT-based mobile applications with occasional in-person counselling, evaluating the effectiveness of a hybrid mental health support model. Exploring such

hybrid approaches would help determine the optimal balance of digital and personal support for university students. Future studies should consider mixed methods, including qualitative interviews or focus groups, to enhance data accuracy to gain in-depth insights into student experiences with digital mental health tools. This approach could provide richer data on user preferences, barriers, and cultural factors influencing app use.

5.6 Areas of Further Research

While this study demonstrated the short-term effectiveness of CBT-based self-management mobile applications for depression, further research is needed to determine the long-term impact of these tools. Specifically, studies that assess symptom reduction over one or more academic years would provide insights into sustained effectiveness and continued student engagement with digital mental health solutions. Research could explore how combining CBT-based mobile applications with in-person support impacts student outcomes. Investigating hybrid approaches would contribute to understanding how digital tools and traditional counselling can complement each other to provide comprehensive mental health support, particularly in low-resource university settings.

These research directions aim to build upon the findings of this study, providing insights into the evolving role of digital mental health interventions and their applicability within diverse, resource-constrained university environments.

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APPENDICES

APPENDIX I: INFORMED CONSENT FORM

Informed Consent Form for Participation in a Study on Effectiveness of CBT-based Self-Management Apps in Reducing Depression Symptoms among university students in Kenya

Introduction:

You are invited to participate in a research study designed to investigate the effectiveness of Cognitive Behavioural Therapy (CBT) based self-management apps in reducing depression symptoms among university students.

If you agree to participate, you will be asked to:

1. Install either one or more of the listed CBT-based self-management apps from Google Play store and use for a period of two months.
2. Complete pre-intervention and post-intervention questionnaires at specific intervals to assess your depression symptoms and collect data on your experiences with the app usage.

The potential risks associated with participating in this study are slight discomfort and inconvenience while completing the two questionnaires.

The study is beneficial in contributing to the understanding of the effectiveness of self-management apps in managing depression symptoms, the challenges barring their use as well as possible solutions, which may benefit you and other university students in Kenya and beyond.

Your personal information will be anonymized, and any data shared in the research reports will be in summative form thus your participation in this study will be rigorously kept confidential. Participation in this study is entirely voluntary and you

can withdraw at any time without any damaging consequences, with no effect on your relationship with the researcher or the university.

If you have any questions or concerns about the study, feel free to contact:

Elizabeth Mbithi on embithi4@gmail.com or phone number/WhatsApp 0734618043

Consent:

By signing below, you acknowledge that you have read and understood the information provided in this document and voluntarily consent to participate in the study.

Participant's name (optional) _____ Participant's email address: _____

Participant's Signature: _____ Date: _____

Thank you for your participation and contribution to this research.

APPENDIX II: PRE-INTERVENTION TEST SURVEY QUESTIONNAIRE

Introduction

Thank you for agreeing to participate in this survey for a study on the effectiveness of self-management apps in reducing depression symptoms in university students. This pre-intervention test survey aims to gather information about your current depression status and usage of self-management apps to manage depression symptoms. Your responses will be kept confidential. Please answer all questions honestly and to the best of your ability.

Section 1: Social-Demographics

1.1. Age: _____

1.2. Gender: Male ☐ Female ☐

1.3. Current Year of Study: 1st ☐ 2nd ☐ 3rd ☐ 4th ☐ 5th ☐

1.4. School of study: _____

1.5. Residence: University Hostel [] KV [] KM [] Kyua [] Other: _____

1.6. Are you currently receiving depression counselling or therapy? [] Yes [] No

Please share your email address for further engagement and follow-up _____

Section 2: PHQ-9 Depression Assessment

2.1. Over the last two weeks, how often have you been bothered by the following problems?

Not at all (0) - Several days (1) - More than half the days (2) - Nearly every day (3)

i. Little interest or pleasure in doing things

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

ii. Feeling down, depressed or hopeless

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

iii. Trouble falling asleep, staying asleep, or sleeping too much

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

iv. Feeling tired or having little energy

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

v. Poor appetite or overeating

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

vi. Feeling bad about yourself - or that you're a failure or have let yourself or your family down

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

vii. Trouble concentrating on things, such as reading the newspaper or watching television

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

viii. Moving or speaking so slowly that other people could have noticed. Or, the opposite - being so fidgety or restless that you have been moving around a lot more than usual

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

ix. Thoughts that you would be better off dead or of hurting yourself in some way

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

Section 3: Self-management App Usage

3.1. Have you ever used a self-management app to manage depression symptoms?

[] Yes [] No

- If yes, please answer the following questions. If no, skip to Section 4.

If you have used a self-management app, please describe your experience briefly.

3.2. What features or aspects of a self-management app did you find most appealing in the context of depression management?

3.3. What challenges or difficulties did you encounter when using self-management apps for depression symptoms reduction?

3.4. What self-management app(s) have you used for depression management? (List the app name(s)):

-App 1: _____

- App 2: _____

- App 3: _____

3.5. How often did you use self-management apps for depression management?

☐ Daily ☐ Weekly ☐ Monthly ☐ Rarely

3.6. On a scale from 1 to 5, how effective did you find these self-management apps in reducing your depression symptoms? (1 = Not Effective, 5 = Very Effective)

[1] [2] [3] [4] [5]

Section 4: General Well-being

4.1. On a scale from 1 to 5, how would you rate your overall well-being? (1 = Very Poor, 5 = Excellent)

[1] [2] [3] [4] [5]

4.2. Do you currently engage in any other activities or treatments to manage your depression symptoms (e.g., therapy, medication, exercise)?

Thank you for participating in this survey. Your input is valuable and will contribute to our understanding of self-management apps' effectiveness in reducing depression symptoms for university students.

APPENDIX III: POST-INTERVENTION TEST SURVEY QUESTIONNAIRE

Introduction:

Thank you for agreeing to participate in this survey for a study on the effectiveness of self-management apps in reducing depression symptoms in university students. This post-intervention test survey aims to gather information about the impact of self-management apps on your depression symptoms after 6 weeks of app use, including a re-evaluation of depression symptoms using the Patient Health Questionnaire (PHQ-9). Your responses will be kept confidential. Please answer all questions honestly and to the best of your ability.

Section 1: Demographics

1.1. Age: _____

1.2. Gender: Male ☐ Female ☐

1.3. Current Year of Study: 1st ☐ 2nd ☐ 3rd ☐ 4th ☐ 5th ☐

1.4. School of study: _____

1.5. Residence: University Hostel ☐ KV ☐ KM ☐ Kyua ☐ Other: _____

1.5. Are you currently receiving depression counselling or therapy? ☐ Yes ☐ No

1.6 Email address: _____

Section 2: PHQ-9 Depression Assessment (Post-App use Evaluation)

2.1. Over the last two weeks, how often have you been bothered by the following problems?

Not at all (0) - Several days (1) - More than half the days (2) - Nearly every day (3)

i. Little interest or pleasure in doing things

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

ii. Feeling down, depressed or hopeless

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

iii. Trouble falling asleep, staying asleep, or sleeping too much

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

iv. Feeling tired or having little energy

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

v. Poor appetite or overeating

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

☐ vi. Feeling bad about yourself - or that you're a failure or have let yourself or your family down

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

vii. Trouble concentrating on things, such as reading the newspaper or watching television

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

viii. Moving or speaking so slowly that other people could have noticed. Or, the opposite - being so fidgety or restless that you have been moving around a lot more than usual

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

ix. Thoughts that you would be better off dead or of hurting yourself in some way

☐ Not at all ☐ Several days ☐ More than half the days ☐ Nearly every day

Section 3: Self-management App Usage (Post-App Use Evaluation)

3.1. Have you used self-management apps to manage depression symptoms during the period since the pre-survey? [] Yes [] No

3.2. If yes, please specify the self-management app(s) you used during the intervention period.

FREECBT ☐ BEING ☐ CBT GUIDE TO DEPRESSION ☐

3.2.1 Please briefly describe your experience while using the app.

3.3. How often did you use self-management apps for depression management during this period?

☐ Daily ☐ Skipped days/ alternate days ☐ Weekly ☐ Rarely

3.4. On a scale from 1 to 5, how effective did you find these self-management apps in reducing your depression symptoms during this period? (1 = Not Effective, 5 = Very Effective) [1] [2] [3] [4] [5]

Section 4: Self-management App Usage / Feasibility

4.1. What features or characteristics of the self-management app used did you find most appealing in the context of depression management?

4.2. What challenges or complications did you encounter when using the self-management app for depression reduction?

Section 5: Self-management App Usage Acceptability

5.1. On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), please rate the following statements:

- The idea of using a self-management app to reduce depression is appealing.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

- I would recommend a self-management app for depression management to a fellow university student.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

5.2. What would make you more likely to use a self-management app for depression management?

5.3. Are there specific concerns or reservations you have about using self-management apps for depression symptoms reduction?

Section 6: Potential barriers in using Self-Management Apps to reduce depression symptoms

6.1. Please indicate the extent to which the following factors might discourage you from using a self-management app for depression management (1 = Not at all, 5 = Extremely):

- Lack of time

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

- Privacy and data security concerns

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

- Difficulty in understanding or navigating the app

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

- Lack of awareness and knowledge on which App to use

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

- App personalization and customization usability

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

- personal motivation and consistency towards app usage

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

- Stigma about seeking depression management help

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

6.2. Are there any other potential barriers to using self-management apps for depression management that you would like to mention?

Section 7: Potential Facilitators to the use of self-management apps to reduce depression symptoms

7.1. Please indicate the extent to which the following factors might encourage you to use a self-management app for depression management (1 = Not at all, 5 = Extremely):

- User-friendly design and interface

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

- Positive reviews and recommendations from peers or professionals

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

- Access to personalized content and support

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

5.2. Are there any other potential facilitators to using self-management apps for depression management that you would like to mention?

Section 8: Additional Comments

8.1. Do you have any additional comments, suggestions, or concerns related to self-management apps for depression symptoms reduction among university students?

Section 9: General Well-being

9.1. On a scale from 1 to 10, how would you rate your overall well-being during this period? (1 = Very Poor, 10 = Excellent)

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

9.2. Did you notice any changes in your overall well-being since using self-management apps for depression during this period? ☐ Yes ☐ No

9.3. If you answered "Yes" in question 4.2, please describe the changes you have noticed.

Conclusion:

Thank you for participating in this survey. Your feedback is valuable in understanding the effectiveness of self-management apps in managing depression symptoms among

university students. Your responses will remain confidential and will be used for research purposes only.

APPENDIX IV: AFRICA NAZARENE UNIVERSITY CLEARANCE LETTER



AFRICA NAZARENE
UNIVERSITY

P.O.Box: 53067 – 00200
Nairobi, Kenya.
Tel: 020 252 7170/1 – 5
Email: vc@anu.ac.ke
www.anu.ac.ke

29th January 2024

RE: TO WHOM IT MAY CONCERN

Elizabeth Mbithi (19M03DMCP018) is a bonafide student at Africa Nazarene University. She has finished her course work and has defended her thesis proposal

entitled: -

"Effectiveness of Selected CBT-Based Self-Management Applications in reducing Depression among University Students in Kenya. A Case of South Eastern Kenya University".

Any assistance accorded to her to facilitate data collection and finish her thesis is highly welcomed.

Prof. Rodney Reed
Deputy Vice Chancellor, Academic & Student Affairs

APPENDIX V: NACOSTI PERMIT

 REPUBLIC OF KENYA Ref No: 701896	 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION Date of Issue: 08/April/2024
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This is to Certify that Ms., Elizabeth Mbiti of Africa Nazarene University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Kitui on the topic: EFFECTIVENESS OF SELECTED CBT-BASED SELF-MANAGEMENT APPLICATIONS IN REDUCING DEPRESSION AMONG UNIVERSITY STUDENTS IN KENYA. A CASE OF SOUTH EASTERN KENYA UNIVERSITY for the period ending : 08/April/2025.	
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APPENDIX VI: SITE MAP

