USING THE CURRICULUM DENSITOMETER TO MEASURE THE IMPACT OF CURRICULAR WORKLOAD ON STUDENTS' MENTAL HEALTH: A PILOT STUDY

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ABSTRACT

Curriculum overload (CO) is major health professional education problem, partly, due to ongoing curriculum reforms. Evidence shows CO can adversely impact students' mental health, and there is little evidence on how to effectively mitigate CO. In my thesis, the aim was to explore the acceptability and feasibility of a new web application (Curriculum Densitometer - CD app.) developed by the research team for measuring curriculum load and student perceived stress.

A total sample of 16 students of enrolled in spring and summer 2020 courses (from the Colleges of Nursing and Medicine, U of S) were used in a convergent mixed methods pre- and post-test design. Participants were administered two pre - and post-test surveys (demographics questionnaire, Kessler's Psychological Distress Scale – K10), and piloted the CD app parallel to completing academic course assignments in-between the pre- and post-test surveys. An Exit individual interview was conducted using 8 volunteers from the 16 participants, followed by both quantitative and qualitative analysis of the collected data.

Majority of the 16 participants were female international postgraduate students over the age of 30 years from the College of Nursing. The qualitative findings showed an acceptability and feasibility among participants, although a number of important implementation factors remain to be addressed to gain broader adoption of the technology. These findings were supported by the high technical feasibility and moderate associations found between the CD app's perceived stress rating scale and the scores obtained from the K10 quantitative analysis. The conclusion was that the CD app is acceptable and feasible to implement. It provides curriculum developers a medium to monitor and calibrate curriculum load. It also provides instructors with a tool to evaluate course load and to identify and support academically struggling students, and gives students an academic planning, advocacy, and self-care tool for promoting appropriate curriculum load distribution.

Keywords: curriculum overload, curriculum densitometer, perceived stress, post-secondary students

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DEDICATION

I would like to dedicate this work to my loving parents, Mr. James Acharibasam and Mrs. Rose Acharibasam, as well as my dear fiancé, Jennifer Gandah, and my siblings (Mr. John Bosco Acharibasam, Florence Acharibasam and Diana Acharibasam) who were all a significant source of emotional support for me in overcoming the difficulties brough on by the COVID-19 pandemic and seeing the work to a successful completion.

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LIST OF ABBREVIATIONS

Abb	Description
CD app	Curriculum Densitometer Application
CO	Curriculum Overload
K10	Kessler's Psychological Distress Scale

CHAPTER ONE

INTRODUCTION

1.1. Background

Curriculum planning in the health sciences has become a difficult puzzle, especially in terms of balancing course workload and maintaining a broad curriculum scope (Adolfsson, 2018; Jamshidi & Cook, 2003; Toews et al., 1997, 1993). Whereas others tend to use empirical methods to identify and teach core subject knowledge, most contemporary curriculum planners resort to an "add-all-you-can" approach to ensure the coverage of both broad and essential subject knowledge (Bandaranayake, 2000, 1985; Deon & Crawford, 2005; Leppink & Duvivier, 2016). However, there is a consensus among many curriculum planners that it is difficult to modify the health sciences curriculum to capture the essential general and subject-specific knowledge while maintaining an adequate curriculum load (Jamshidi & Cook, 2003). This problem can lead to a mismatch between teachers' and students' capacity to activate and fulfill an overloaded curriculum (National Council for Curriculum and Assessment [NCCA], 2010). Thus, educational practitioners must begin interrogating the balance between broad curriculum workload and subject-specific knowledge within post-secondary institutions.

Several factors can be responsible for the challenges of curriculum development. In recent years, the factors in the health sciences accounting for these curriculum planning difficulties include expanding wealth of subject knowledge, growing need for self-directed learning and hurried schools/classrooms, increasing diversity of the student population and need for diversification of the curriculum, and increasing interdisciplinary programming (Adolfsson, 2018; Bandaranayake, 2000; Biggs & Tang, 2011; Deon & Crawford, 2005; Entwhistle, 1992; Merrienboer & Sweller, 2010; Premkumar et al., 2018; Sissons, Swartz, & Wolf, 1992). Teaching the core subject knowledge may reduce curriculum load, but it may not adequately capture the general health sciences knowledge. On the other hand, the "add-all-you-can" approach may tend to overload the curriculum consistently. This seeming lacuna is what informed this study.

1.2. Statement of the Problem

Rising curriculum overload (hereinafter referred to as C.O) presents unique challenges for health sciences curriculum planners in post-secondary schools, including contributing to behavioural health problems among students such as emotional burnout, dependency on psychoactive drugs, sleep disorders, anxiety, depression, and low academic performance (Amanya, Nakitende, & Ngabirano, 2017; Boni et al., 2018; Egnew et al., 2018; Ellaway et al., 2014; Heinen, Bullinger, & Kocalevent, 2017; Houpy et al., 2017; O'Regan, 2005; Reddy, Menon, & Thattil, 2018; Sweller et al., 2019; Vergel et al., 2018). Although attempts are being made through the development of digital curriculum tools like the ***Rice University Course Workload Estimator*** to help instructors gauge the right course load given to students, there is still little evidence on exactly how long it takes a post-secondary student to complete an average academic task (Barre, 2016). Moreover, how to effectively assess curriculum overload and its psychological effects, as well as ways to mitigate the problem in post-secondary school health sciences programs, is also less known in the literature (Lacombe et al., 2014; Salvin, Schindler, & Chibnall, 2014).

The existing evidence shows that the current solutions have been reactive (i.e. identifying distressed students and enhancing access to and use of mental health services) or supplementary/preventive (i.e. providing programs to mitigate the negative aspects of health education) (Salvin, Schindler, & Chibnall, 2014). Whereas the former engages in solutions such as improving access to mental health, mental health assessment, and educating students on mental health, the latter focuses on providing counseling services, educating faculty members on student mental health, and introducing elective mental health courses for students (Salvin, Schindler, & Chibnall, 2014). Unfortunately, these solutions have been criticized as limited in scope as they may not reach all students within the university environment (Salvin, Schindler, & Chibnall, 2014). In contrast, an emerging solution is the person-in-context or health promotion approach which takes a curriculum innovation stance and targets specific elements of the context/curriculum associated with poor student mental health (Stallman, 2010). For example, this approach involves curriculum reforms and innovations (teaching methods and grading scheme reforms) aimed at fostering student mental health (Camp et al., 1994; Rohe et al., 2006). This approach is guaranteed to reach all students within the school environment exposed to the

curriculum. However, a challenge is how to identify the overloaded elements of the curriculum that linked to poor student mental health for curriculum reform.

1.3. Purpose of the Study

This pilot study's primary purpose was to assess the acceptability and feasibility of a newly developed mobile-web application, named 'Curriculum Densitometer' (hereinafter referred to as CD app) re-designed to measure course assignment workload and student perceived stress. The CD app was conceptualized by Dr. Kalyani Premkumar and initially designed and developed by students of the Saskatchewan Polytechnic Computer Science Class. Several limitations were identified in the earlier version, which resulted in a re-design and development of the application by Jeremiah Acharibasam and Thai Le Kha (MSc. student) under Dr. Ralph Deters' supervision. This study aimed to pilot the CD app in different courses in the Colleges of Medicine and Nursing at the University of Saskatchewan. In the study, the participants used the application to measure course assignment workload (i.e., time spent completing an assignment) and perceived stress associated with these assignments. A secondary goal was to examine students perceived psychological distress using the Kessler's Psychological Distress self-report questionnaire (K10) (Appendix A) (Kessler et al., 2002).

1.4. Aim(s) / Objective(s)

Two main objectives drove the current study: First, it was to explore the acceptability and feasibility of the CD app in measuring C.O. and students' perceived stress levels. The second was to assess the link between the CD app's perceived stress scale and the standardized Kessler's Psychological Distress Scale (Kessler et al., 2002).

1.5. Research Question

How feasible and acceptable will participants perceive the CD app for measuring C.O and perceived stress?

1.6. Hypotheses

I. There is technical feasibility for the CD app among students.
II. The students' perceived stress scores obtained on the CD app will positively correlate with their scores on the Kessler Psychological Distress Scale (K10).

1.7. Definition of Terms

I. *Curriculum Overload (C.O)*: refers to when students spend more time (i.e. hours, minutes, and seconds) on the given academic course activity/tasks compared to the instructor's estimate of the average time for completing the task.

II. *Perceived stress*: a person who obtains an average score of 5.0 or more on the CD app stress rating scale.

III. *Psychological distress*: a person who obtains a score of 20 or more on the Kessler Psychological Distress Scale (K10).

1.8. Theoretical Perspective(s):

The conceptualization and evaluation of an implementation's success or performance is a significant challenge for most applied studies (Procter et al., 2011). Since this study aims to pilot the CD app, the focus is on two of the recommended implementation outcome indicators when introducing new technology (i.e., acceptability and feasibility) (Procter et al., 2011; Gammon et al., 2008). Acceptability is the perceived agreeableness, palatability, or satisfaction among stakeholders regarding an innovation (Procter et al., 2011), while feasibility involves how a new solution can be successfully used or carried out within the target setting (Karsh, 2004).

Even though several theoretical perspectives can explain this study, the ones considered critical for this particular study are Diffusion of innovation theory; Theory of reasoned action; Social Cognitive Theory; Model of Acceptance with Peer Support, and Unified Theory of Acceptance and Use of Technology.

1.8.1. Diffusion of Innovation Theory

The literature shows that many contrary views exist on technology adoption and diffusion across different contexts (Lai, 2017; Sharma & Mishra, 2014; Nechully, Pokhriya, & Thomas, 2018). Rogers' (1966) Diffusion of Innovation Theory (DIT) was the earliest model to explain users' willingness to accept and use new technology. The DIT proposed that new technologies must go through several communication stages to gain user uptake, including user understanding, inducement, decision, execution, and authentication (Rogers, 2003). Thus, innovation adoption is considered a social communication process (ibid).

1.8.2. Theory of Reasoned Action

Another model emerged in the 1970s, called the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980), which offered a different view of user adoption of innovation. To the TRA, a user's attitude towards an act or behaviour and the subjective norms within the user's social sphere leads to their behavioural intention to use and subsequent actual use of the innovation (Ajzen & Fishbein, 1980). The Theory of Planned Behaviour (TPB) later emerged from the TRA, which introduced perceived behavioural control as a key adoption factor (i.e. user perception of the ease or difficulty of performing the behaviour of interest required by the technology) (Ajzen, 1985).

1.8.3. Social Cognitive Theory

The Social Cognitive Theory (SCT) was also introduced later by Bandura (1977). The SCT believed that user adoption of innovation was determined by the user's perception of self-efficacy or one's capacity to use the technology to achieve a given task and the expectations of outcome related to personal or performance benefits (Bandura, 1986). In the 1990s, the Task-technology Fit (TTF) theory was introduced, which supported the SCT's view that a good fit must exist between the task to be performed and the given technology for user adoption to occur (Goodhue et al., 1995).

1.8.4. Model of Acceptance with Peer Support

However, a more recent model, Model of Acceptance with Peer Support (MAPS), appears to take a different view on user innovation adoption (Sykes, Venkatesh, & Gosain, 2009). The MAPS takes a social network approach to innovation adoption and argues that innovation adoption is mostly influenced by the user's social ties and the user's ability to give and get help when using the innovation (ibid).

1.8.5. Unified Theory of Acceptance and Use of Technology

Despite the diverse views on user innovation adoption, the Unified Theory of Acceptance and Use of Technology [UTAUT] (Venkatesh, Morris, Davis, & Davis, 2003; Davis, 1985) guided this present study. Like the Theory of Planned Behaviour (Ajzen, 1985), the UTAUT also emerged from the Theory of Reasoned Action (Ajzen & Fishbein, 1980). The UTAUT originated

from several years of modifications made to the basic Technology Acceptance Model [TAM] (Venkatesh & Davis, 2000; Yang & Yoo, 2003).

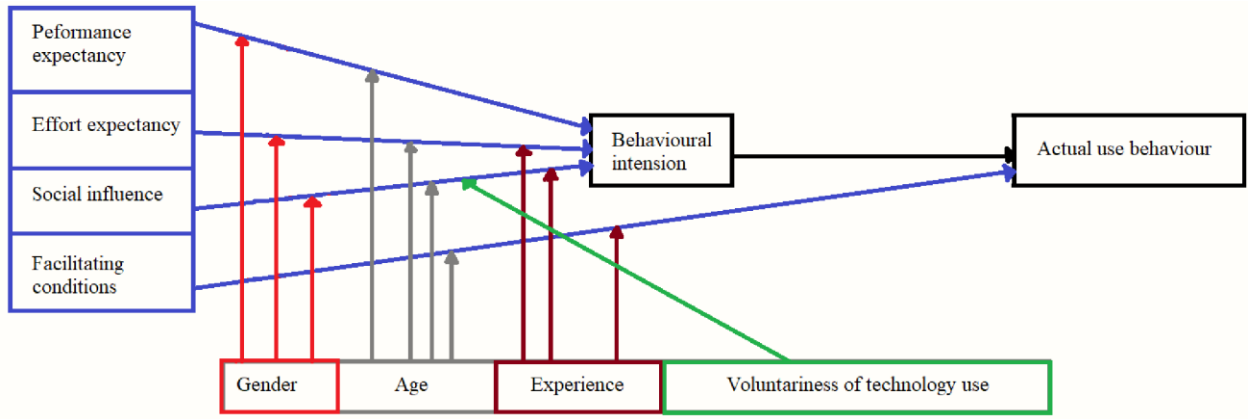
The earliest version of the TAM held that adoption of new technology innovation was determined by user motivation, which was influenced by two main factors: perceived usefulness (P.U.) and perceived ease of use (PEU) (Davis, 1985). These factors then predicted users' attitudes towards using and real usage of the innovation (Davis, 1985). This explanation was later found inadequate as it ignored other extraneous factors which influence P.U. and PEU (Venkatesh & Davis, 2000). TAM 1 was thus introduced as an update to the basic TAM (Davis, Bogozzi & Warshaw, 1992). TAM 1 indicated that both P.U. and PEU could be influenced by external factors (Davis, Bogozzi & Warshaw, 1992). Also, TAM 1 showed that a third factor, usage intention, mediated the association between the real use of new innovation and user P.U. and usage attitude (ibid).

In later research, Venkatesh and Davis (2000) found that both P.U. and PEU directly predicted user behavioural intention, and thus, user attitude was removed in the second version of TAM. TAM 2 introduced the concept of antecedents (i.e., external factors) as predictors of user P.U., including subjective norms, social image, job relevance, output quality, and results demonstrability (ibid). Experience and voluntariness of use were also found to moderate these associations (ibid) in the TAM 2. However, TAM 2 did not fully address the predictors of PEU, which led to a further revision of the model into TAM 3 (Venkatesh & Bala, 2008). TAM 3 proposed two new concepts called anchors (i.e., general beliefs about new technology and its usage) and adjustments (i.e., users' views shaped based on actual user experience) to elucidate the predictors of user PEU (ibid). Examples of some anchors include technical self-efficacy, sense of external control, computer anxiety, and computer playfulness (ibid). TAM 3 also argues that sense of enjoyment and practical usability are some adjustment predictors of PEU (ibid).

After TAM 3, there was a need to unify the earlier versions into a holistic model that explains user innovation adoption behaviour. This effort led to a final version, UTAUT (see Figure 1.1) (Venkatesh et al., 2003). The UTAUT draws attention to performance expectation, effort expectation, social influence, and supporting conditions as the main predictors of user behavioural intention and actual use behaviour. Also, the UTAUT argues that user demographic

characteristics tend to moderate these preceding predictors' impact on user behavioural intention. These demographic factors include age, experience, gender, and voluntariness (ibid). For this study, the UTAUT was applied to holistically explore, understand, and explain the mechanisms behind the CD app's feasibility and acceptability among post-secondary health sciences students. Therefore, this model was chosen as it has a high ability (70%) to explain the variance in user technology adoption behaviour in different contexts and with different users and technologies (Venkatesh et al., 2003).

Figure 1.1: Unified Theory of Acceptance and Use of Technology (UTAUT)



* Performance expectancy, effort expectancy, social influence, and facilitating conditions are the main predictors of user behavioural intention and use behaviour. Users' demographic characteristics, including gender, age, experience, and voluntariness of technology use, are the moderators of the association between the predictors and user behavioural intention and use behaviour.

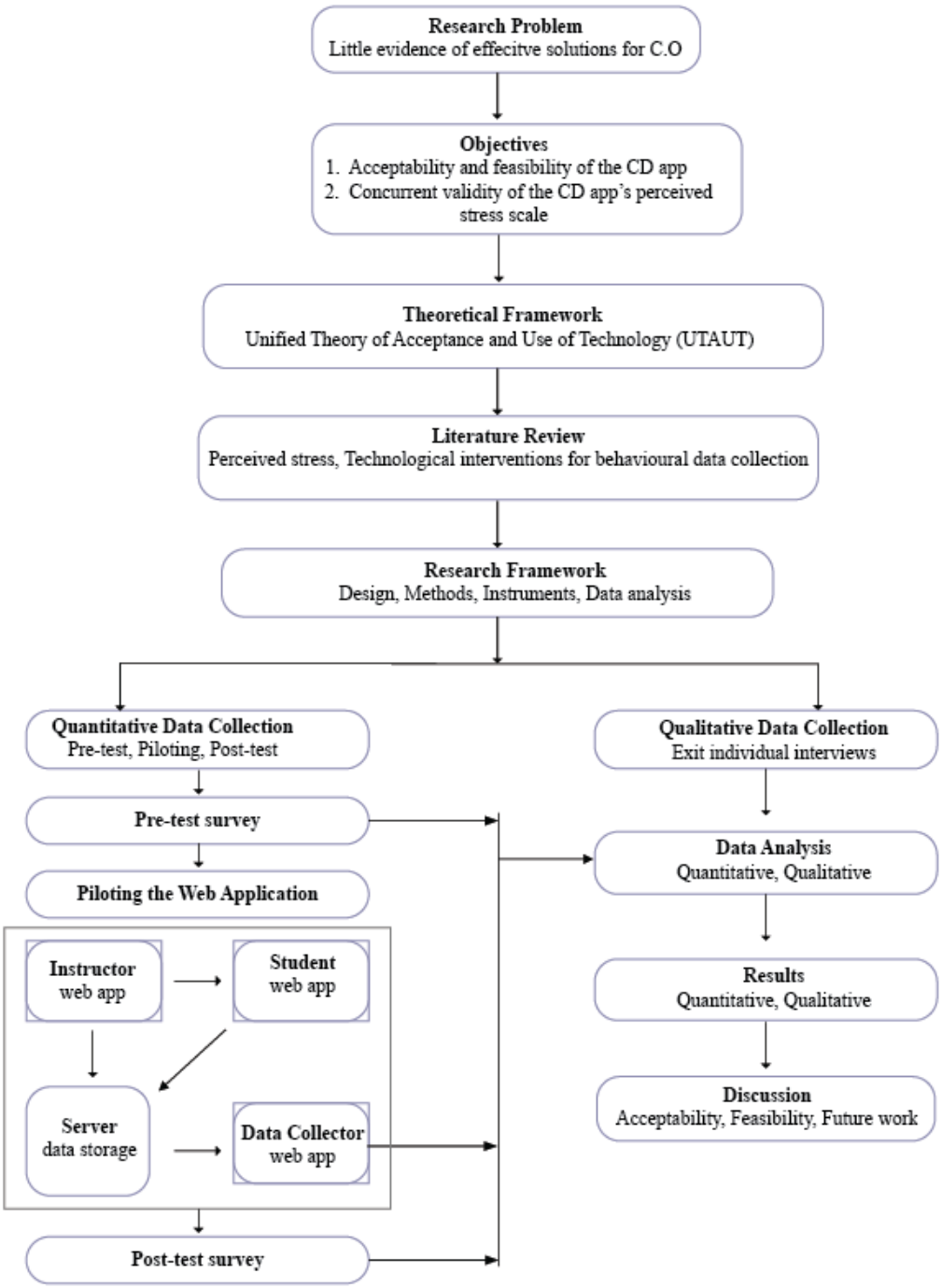
Source: Adapted from Venkatesh et al. (2003)

1.9. Structure of the Thesis

The thesis is organized into five main chapters. Chapter one presents background on curriculum overload and the theoretical framework that guided the study. It also outlines the aims, research question(s), hypotheses and structure of the thesis. The second chapter provides a comprehensive review of existing literature on associations between curriculum load and students' perceived stress within the health sciences. The development of the CD app and

methodology of conducting the study is described in the third chapter. Chapter four presents the study results and Chapter five comprises of the discussions of these findings, conclusion, limitations and recommendations of the research for future studies.

Figure 1.2: Conceptual Model of Thesis Work



1.10. Summary

The preceding chapter discussed curriculum overload within post-secondary health sciences programs and its effects on students' mental health. Additionally, the study's theoretical foundations, the aims, purpose, research question(s) and hypotheses, and a summary of the study's main structure were also presented. The study was driven by the need to explore innovative ways to effectively assess and determine the effects of curriculum overload on student's psychological health. To achieve this purpose, the main objectives were to explore the acceptability and feasibility of a newly developed CD app, and to provide preliminary concurrent validity results for future validation of the app's perceived stress scale by assessing the association of participants' scores to those they obtained on the K10 scale. The UTAUT model was thus chosen to help conceptualize the study and to explain its findings.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

Starting post-secondary school is a major life transition that may represent a considerable challenge, especially for health sciences students because of the excessive curriculum workload of most post-secondary health sciences programs (Adolfsson, 2018; Jamshidi & Cook, 2003). According to Cohen, Kamarck, and Mermelstein (1983), perceived stress involves thoughts and feelings a person has regarding the degree of stress he or she believes to be undergoing during a given life event at any time period. Studies have shown that, after enrolling in health sciences programs, including nursing and medicine, students' stress levels rise higher than the general population (Lacombe et al., 2014; Smith et al., 2007; Stallman, 2010; Wierenga, Landstedt, & Wyn, 2013). Besides the usual challenge of dealing with excessive course work, fulfilling multiple difficult examinations, and meeting high academic grading standards, health sciences students also face many other unique challenges (Gaensbauer & Mizner, 1980; Hill, Goicochea, & Merlo, 2018; Pruthi & Goel, 2014;). For example, health sciences students have to balance their school work with the demanding volume of clinical practice, manage overscheduled clinical placement routines, handle challenging encounters with patients, endure long training hours, make difficult medical decisions, and interact with bereaving families (Pruthi & Goel, 2014). It is important, however, to acknowledge that, the training regimen students are subjected to within the health sciences are not homogenous, and thus, medical training may vary from the rest of the health sciences programs (ibid). Hence, it is assumed that the experience of perceived stress among medical students may be unique. There has been some research interest on the effects of curriculum load on health science students' mental health, because their psychological well-being may have repercussions on the quality of care for future patients (Gaensbauer & Mizner, 1980). Unfortunately, there is little evidence of effective solutions (including technological tools) for systematically measuring curriculum load and student perceived stress to better understand the dynamic mechanisms underlying the link between curriculum load and student mental health.

2.2. Components of the Curriculum as a Source of Perceived Stress

One group of studies draw attention to stressful curriculum features (Alsulami et al., 2018; Hill, Goicochea, & Merlo, 2018; Lindsay & Rogers, 2010). These researchers argue that experience of chronic stress among health sciences students mainly originates from a high load in the density, concurrency of multiple courses, course difficulty, quantity of certain curriculum features, and low resource support available to students. For instance, there are associations between the volume and number of course credit hours and students' stress (Lindsay & Rogers, 2010; Naidoo et al., 2014). The evidence also shows that students vary in their reading and writing rates which are often dependent on page density, text difficulty, reading purpose, text genre, and amount of drafting and revisions done (Dehaene, 2010; Love, 2012). Thus, the amount of academic work, simultaneous hand-in assignments and deadlines, frequency and duration of lectures, difficulty of examinations, high-performance requirements, imbalanced parallel course loads, and low academic support will all affect students differently in relation to their experience of perceived stress (Alsulami et al., 2018; Naidoo et al., 2014; Sweller, Merriënboer, & Paas, 2019). Research also indicates that students are hardly offered the opportunity to report how long it takes them to complete academic tasks, which may result in a likelihood among instructors to underestimate specific assignment loads due to lack of awareness of concurrent course load demands being fulfilled by these students from other courses (Barre, 2016). Similar findings have been reported among undergraduate medical students where time restraints and hectic schedules were found to have a strong association with students' stress scores (Altaf et al., 2013; Hill, Goicochea, & Merlo, 2018; Reed et al., 2011; Smith et al., 2007; Sreeramareddy et al., 2007).

Although it is essential to understand the curriculum's perceived structural elements that add to student perception of stress, the overemphasis on this orientation seems to downplay the significant contributions of other factors to student perception of curriculum load and experience of perceived stress.

2.3. Student Mental Adaptability as a Source of Perceived Stress

There is a class of studies that are concerned with students' mental adaptability to curriculum workload. These researchers argue that the coping styles students are accustomed to

or their level of psychological resilience may predispose them to curriculum workload stressors. This research stream has associated several student personal attributes including isolationism, stoicism, sense of identity, sense of self-efficacy, personality, spirituality, addictive behaviour, age, and gender with students' perception of excessive workload and subsequent experience of stress (Egnew et al., 2018; Ellaway et al., 2014; Gaensbauer & Mizner, 1980; James et al., 2017; Kötter et al., 2017; Naidoo et al., 2014).

In this line of research, the literature also shows that certain psychological attributes may serve as buffers against perceived stress. One of such mental attributes is the idea of self-efficacy, an essential personal attribute introduced by the social cognitive theory (Bandura, 1977). According to Bandura (1977), self-efficacy is one of the crucial psychological processes, a belief in one's capability to successfully organize and carry out the courses of action needed to manage prospective situations (Bandura, 1995, p.2). In other words, self-efficacy beliefs held by individuals influence their life choices, the effort they exert to execute these choices, the persistence and perseverance they exhibit in pursuing these choices despite the hurdles of life, and the level of anxiety or peace they encounter as they carry out different activities in their lives (Locke & Bundara, 1987). Thus, self-efficacy is a critical element of human motivation for effort exertion and persistence through stressful life events. For instance, education research shows that students' self-efficacy is a strong predictor of academic satisfaction and achievement (Levy, 2007; Schunk, Meece, & Pintrich, 2014; Usher & Pajares, 2008, p. 751).

On the other hand, self-efficacy can also become a self-fulfilling prophesy where individuals can get caught up in a vicious cycle of low confidence in their ability to escape certain life stressors (Gecas, 2004). When low self-efficacy self-fulfilling prophecy occurs, it may result in stoicism (which appears to reduce stress) or learned helplessness, which may exacerbate one's experience of stress. Stoicism is a positive, deliberate philosophical stance/mental state of emphasizing internal over external events to achieve internal happiness and tranquillity from destructive emotions (Papadimos, 2004). Stoicism could be a beneficial coping mechanism to deal with curriculum overload (Huecker, 2020; Papadimos, 2004; Sellars, 2006). In contrast, learned helplessness is often an adverse unintentional, maladaptive coping strategy of passivity to uncontrollable life stressors (Swanson & Dougall, 2017).

A merit of this conceptualization of curriculum load and student perceived stress is that it draws attention to the interaction between behavioural factors and structural curriculum components. However, these researchers focused less on some extraneous factors, including the learning context, financial responsibilities, and institutional barriers that could impact curriculum load and induce student perceived stress. Viewing students' suffering of perceived stress as an indicator of their psychological resilience to curriculum load is also an oversimplification of students' lived experience of stress and may perpetuate a victim-blaming language that does nothing to advance knowledge on students' mental health.

2.4. External Factors as a Source of Perceived Stress

A more dialectical view of curriculum load and student perceived stress involves the idea that, besides structural curriculum elements and student psychological qualities, perceived stress emanates from several other sources (Reddy, Menon, & Thattil, 2018; Sweller et al., 2019). This school of thought advances the argument that curriculum load and perceived stress among health sciences students are not merely a consequence of curriculum burden and students' psychological predisposition but an integrative process involving several extraneous stressors. Other contextual stressors may exacerbate the interactive effect of curriculum load and personal attributes. Many students experiencing curriculum-related perceived stress may also be facing pre-existing challenges, including low self-efficacy, optimism, work-life difficulties, interpersonal problems, excessive fear of failure, poor time management, and low resilience (Ellaway et al., 2014; Heinen, Bullinger, & Kocalevent, 2017; Reddy, Menon, & Thattil, 2018).

When curriculum load and personal characteristics interact with other external factors (, financial challenges), the collective risk of experiencing significant perceived stress may be at its highest. Besides, having limited study facilities, perceived institutional administrative failures, poor career counselling services, financial constraints, and even the culture of a medical school could contribute to perceived chronic stress among health science students (Hill, Goicochea, & Merlo, 2018; James et al., 2017; Reddy et al., 2018). These factors compound the individual impacts of either curriculum overload or student personal coping capacity.

On the other hand, evidence from positive psychology shows that positive psychological attributes can mitigate the impact of different stressors (Lambert, Passmore, & Holder, 2015).

For instance, Seligman's (2013) PERMA model explains that pleasure, engagement, meaning, positive relationships, and accomplishments are essential authentic happiness pathways to subjective well-being. Diener and Ryan's (2009) work also indicates that individual well-being is a trait that emerges from one's inherited or habitual tendencies to experience the world in specific ways, such as having an optimistic worldview. For instance, Conversano et al. (2010) found that optimism indirectly influences positive coping styles such as seeking social support and focusing on life stressors' beneficial aspects. Similarly, Lee et al. (2019) showed in their study that optimism is essential to promoting longevity. Likewise, some other researchers believe that high self-efficacy significantly contributes to academic satisfaction and achievement, improving well-being (Levy, 2007).

However, the current evidence remains inconclusive on the role of some external factors such as student demographic characteristics (gender, age, marital status, ethnicity/migration background, employment status, and year of academic study) on the association between curriculum load and perceived stress (Heinen, Bullinger, & Kocalevent, 2017; Kötter et al., 2017; Naidoo et al., 2014; Smith et al., 2007; Sweller et al., 2019).

It is essential to recognize the several merits of this multidimensional view of curriculum load and student perceived stress. One, this eclectic view of curriculum load and student perceived stress addresses the limitations of the other two schools of thought on student perceived stress by presenting a holistic perspective to understand the potential mechanisms underpinning interactions between students' perception of a stressful and overloaded curriculum. It also places focus on external sources of student perceived stress, which seems to be ignored by the first two views.

2.5. Stress, Mental Health, and Interventions

Stress has several consequences on wellbeing and academic progress (Mcewen, 2007; Clark et al., 2006). The suffering of chronic stress among health science students has detrimental impacts on students, including emotional exhaustion/burnout, reduced resilience, depression, and unsatisfactory academic progress (Egnew et al., 2018; Ellaway et al., 2014; Heinen, Bullinger, & Kocalevent, 2017).

Studies show that many efforts are used at institutional and individual levels to mitigate perceived stress within health sciences education. At the personal level, students are commonly found to engage in various coping strategies in response to curriculum workload-related stress: depersonalization, self-distracting, emotional suppression, compartmentalization, use of psychoactive drugs, and seeking emotional support from peers, among others (Egnew et al., 2018; Reed et al., 2011; Sreeramareddy et al., 2007).

Whether a health sciences educational institution perceives student stress as emerging from student personal resilience capacity or the curriculum, the stress intervention adopted may vary. For institutions that attribute stress to curriculum overload, they tend to adopt structured stress interventions, including tweaking teaching methods, curriculum restructuring, grading scheme reforms, and introducing required mental health courses for students (Chen et al., 2015; Ellaway et al., 2014; Pereira et al., 2015; Potash, Chen, & Tsang, 2015; Slavin, Schindler, & Chibnall, 2014). In contrast, institutions that think that stress is unique to each student may engage in individualized interventions including, organizing mental health skills-building activities, small-group discussions, creating safe spaces for emotional venting, and developing guidance and counselling services (Anton et al., 2016; Dyrbye et al., 2017; Egnew et al., 2018; Tucker et al., 2017). Whereas the structured approach aims to eliminate curriculum-related stressors to reduce students' stress experience, individualized interventions seek to build students' mental resilience and capacity to overcome curriculum-related stressors (Gaensbauer & Mizner, 1980).

2.6. Technological Interventions for Behavioural Data Gathering

From a review of the literature, there is little evidence of effective technological solutions that address curriculum overload and student perceived stress. There are currently no mobile-web applications that simultaneously measure curriculum load and student perceived stress, especially among post-secondary health professional students. The growing advancements in ubiquitous mobile and personal computing technology and the high diffusion rate of mobile phones, however, presents an opportunity to reexamine the problem of curriculum overload and student perceived stress discussed in the previous sections from a data-driven perspective (Lattie, Lipson, & Eisenberg, 2019; Gutierrez et al., 2017). Unlike prior research, which often relies on

cross-sectional data, advances in web and smartphone technology offer a unique opportunity to gather timely streaming longitudinal behavioural data from students to create more targeted mental health interventions using the CD app. This CD app can continuously collect massive data on the teaching and learning process and student mental health status (i.e. perceived stress), assisting in targeted curriculum innovation and student mental health intervention planning.

Research shows that most mobile phone users often have their mobile devices turned on and close to them any day of the week, location, or time of day (Dey et al., 2011; Patel et al., 2006). Similarly, other studies indicate that most college students often carry their smartphones with them and spend a considerable amount of their Internet time via these smartphones (Dey et al., 2011; Lattie, Lipson, & Eisenberg, 2019). The frequent proximity of smartphones to owners and convenient Internet access via these devices makes them an ideal platform for passive and active unobtrusive, continuous behavioural data gathering and supporting personal, pervasive healthcare delivery-related applications (Gravenhorst et al., 2014; Harari et al., 2016).

However, several important issues need to be considered when applying these smartphone Internet applications to gather behavioural information. One is the low user retention rates. Studies found that 25% of app users tend to discontinue usage after a single use (Rodde, 2019; Statistica, 2019b; Torous et al., 2018). Thus, data gathered through mobile devices may not represent the general target population (Althoff, 2017; Monteith & Gleen, 2016). Also, user attitude towards mobile-internet applications is a concern. While the idea of ubiquitous self-monitoring and continuous self-reporting sounds appealing, users may also find this process overly intruding, annoying, or burdensome (Bauer et al., 2017). Furthermore, ethical concerns and fears of privacy violation associated with self-reporting of personal data via smartphones may create user distrust and reduce uptake (Marakhimov & Joo, 2017). Lastly, the questionable accuracy of the self-reported data derived via these smartphone Internet applications is a significant problem. Inaccuracies in the data, including over or under-reporting of symptoms, could result in misclassification and low validity of the findings obtained through mobile-internet mediums (Hwang, 2020; Bhat et al., 2015; Murakami et al., 2016; Toon et al., 2016).

Despite the above limitations, delivering psychological assessment and mental health care via smartphones and Internet technologies has been proven feasible (Chung et al., 2018;

Lattie, Lipson, & Eisenberg, 2019). Growing research has also revealed that Internet- and smartphone-based assessments can have equivalent accuracy and consistency to existing traditional measures (Burghart et al., 2017; Ballegooijen et al., 2016; Chakhssi et al., 2018; Chin & Leung, 2018; Dijksman, Dinant, & Spigt, 2016; Kwon et al., 2013; Kessler et al., 2002; Nguyen et al., 2015; Weber et al., 2018). Thus, this study was interested in examining the association between scores on the CD app's perceived stress scale and those of the Kessler's Psychological Distress Scale [K10] (Kessler et al., 2002). The aim was to use the findings produced to inform future work on establishing the concurrent validity of the CD app's scale. Concurrent validity involves the level of concordance between two different measures (Miller, Lovler, & McIntire, 2013). The K10 is an extensively validated 10-item questionnaire that yields a global estimate of non-specific mental distress based on questions about anxiety and depression outcomes experienced within the most recent four-week period (Stolk, Kaplan, & Szwarc, 2014). A validation study with a Canadian sample showed that the K10 has a high internal consistency with a Cronbach alpha (0.80) and screening sensitivity and specificity of 86% and 83%, respectively (Sampasa-Kanyinga, Zamorski, & Colman, 2018). Thus, the preliminary results on the association between the CD app's perceived stress rating scale and the K10 scale provide a basis for understanding the reliability of using mobile devices to gather behavioural health data in the teaching and learning environments.

2.7. Philosophical Assumptions

A researcher's concept of reality and knowledge are fundamental in the research process as these inform her/his conceptualization and approach to conducting research. In this section, I reflect on my ontological (the concept of reality) and epistemological (concept of knowledge) groundings as the foundation of this research. I also briefly discuss who I am and how my presumptions may have facilitated or hindered the research process.

According to Mosselson (2010), research is influenced by one's worldview about reality and ways of knowing it. Gubba (1990) sees worldview (also called a paradigm, epistemology, and ontology) as a group of fundamental beliefs that guide action. Creswell and Creswell (2018) further explain that worldviews often include general philosophical orientations held by a researcher regarding the research process's world and nature. Several philosophical perspectives

can inform studies. One philosophical orientation is the post-positivist paradigm often applied in quantitative studies. This perspective argues that only one universally discoverable truth exists and that truth can be objectively studied with careful empirical observatory procedures (Phillips & Burbules, 2000).

In contrast to the positivist perspective, we have the social constructivism paradigm (Mertens, 2010). Often used by qualitative researchers, constructivism holds that individuals are active co-constructors of truth and that truth is subjective to individuals. Thus, they argue that there are multiple truths, and social reality is complex (ibid). While quantitative researchers seek to produce a single generalizable truth, qualitative inquiries recognize the complexity of social reality and seek to elucidate these multiple subjective truths (Lincoln, Lynham, & Guba, 2011; Mertens, 2010).

Besides these two major paradigms, the third group of scholars embrace a pragmatic perspective to knowledge inquiry (Tashakkori & Teddlie, 2010). Pragmatism is a dialectical stance that holds no single worldview. Pragmatism mainly concerns itself with choosing the most suitable research methods (from both qualitative and quantitative) that best solves the research problem under investigation (ibid). This paradigm underlies the mixed methods research design (ibid). My worldview could be seen as dialectical per my cultural, religious, linguistic, and academic backgrounds. According to Creswell and Creswell (2018), worldviews can originate from several sources, including an individual's past experiences, culture, professional disciplines, social communities and academic mentors. As a person born in the Northern part of Ghana in Africa, my ethnic group's culture significantly influences what I see and the meanings I attach to what I see. I come from a border town located between Ghana and Burkina Faso, called Paga. My language-speaking group is called the Kassena and speaks the Kassem local dialect. To the Kassena-speaking language group, multiple realities and co-construction of meaning from communal social relationships are central philosophical tenets of ethnic culture and religion (African Traditional Religion - ATR). Thus, the beliefs I brought to this study as a researcher underpinned the type of knowledge inquiry methods I adopted (Creswell & Creswell, 2018).

Also, the Dialectical perspective (dialectical pluralism, process philosophy) argues that holding different worldviews can be advantageous as it creates a dialogical process where the

contradictions, tensions, and oppositions arising from these diverse perspectives produce new knowledge about the world (Greene & Hall, 2010; Johnson & Stefurak, 2013). Although I was raised a child on the African Indigenous Knowledge system, my academic training has mainly been in the quantitative and post-positivist ontologies and epistemologies. Linguistically, my local dialect is Kassem, but formally I was educated in the English Language, according to the British colonial curriculum (a remnant of Ghana's British colonization). Therefore, possessing a dialectical worldview contributed significantly to the conceptualization of my research question(s) and the choice of a mixed-methods design adopted for the research inquiry and the knowledge narrative produced by the study.

2.7. Summary

The preceding chapter provides background literature on curriculum overload, student stress and related interventions. Specifically, the three existing conceptualizations of student stress and institutional approaches to tackle this problem were discussed. The chapter also explored the rise and advances in information communication technology and the high rate of smartphones and the Internet and their viability in gathering data on students' stress and curriculum overload. The unique opportunities presented by this new trend in technological advancements were also highlighted, and related challenges and solutions to applying smartphone technology to gathering behavioural data were also outlined. This chapter concluded by contrasting the different major philosophical foundations in research and the researcher's philosophical orientation.

CHAPTER THREE

METHODS

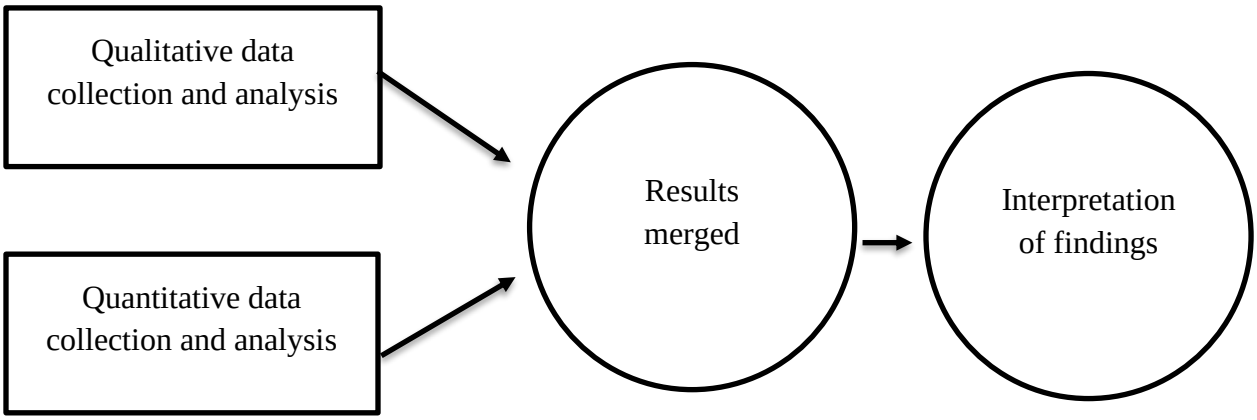
3.1. Introduction

This section provides details of this study's design, description of the CD app, setting(s) description, participants and recruitment procedures, study outcome measures, factor(s) measures, data analysis procedures, and ethical considerations.

3.2. Design

As indicated in the philosophical foundations' section (p.17-19), my ontological and epistemological background influenced my choice of study design. A convergent mixed methods design (see Figure 3.1, p. 20) was chosen to help obtain a holistic comprehension of the CD app's acceptability and feasibility (Creswell & Creswell, 2018; Wittink, Barg, & Gallo, 2006). The mixed-methods design often involves gathering and analyzing, integrating, and making inferences with quantitative and qualitative methods in a research study (Greene, 2007; Hesse-Biber, 2015; Johnson, Onwuegbuzie, & Turner, 2007; Tashakkori & Creswell, 2007b). Thus, the choice of research design, per the pragmatism worldview, was influenced by a desire to engage multiple worldviews (quantitative data and qualitative data) in exploring the CD app's feasibility and acceptability (Bryman, 2006; Creswell & Plano Clark, 2011; Morse, 2003; Tashakkori & Teddlie, 2010).

Figure 3.1: Diagram of the Convergent Mixed Methods Design



Source: Adapted from Creswell and Plano Clark (2011)

An Explanatory Sequential mixed methods design (Creswell and Plano Clark (2011) was previously proposed for this study, which was later replaced by a Convergent mixed methods design (ibid) (with approval from the University of Saskatchewan Behavioural Ethics Board) because of participant recruitment challenges faced during the emergence of the COVID-19 pandemic. Many course instructors within the Colleges of Medicine and Nursing were approached by the researcher to involve their courses in the study, but most declined due to several COVID-19-related teaching and learning transitions introduced by the University of Saskatchewan at the time. Thus, the Convergent mixed methods design allowed the researcher to refocus the study to a qualitative study supported by a minor quantitative component.

3.2.1. Quantitative Data Collection

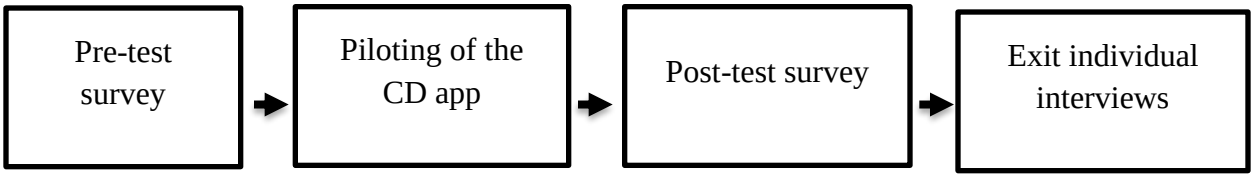
The study comprised of four main phases (see Figure 3.2, p. 22). The initial stage involved administering a pre-test demographic questionnaire and the Kessler's Psychological Distress Scale (K10) (Kessler et al., 2002) [Appendix1] to a volunteer sample of 16 health sciences students in the Colleges of Medicine and Nursing, University of Saskatchewan. Afterward, these participants used the CD app to track their time spent while completing their respective take-home assignments for an academic course they were enrolled in during the 2020 spring, summer, and fall academic semesters. The CD app was made accessible to participants online as a web-application. It could be used from any given location as long as participants had access to an Internet connection. Only students who completed the pre-test surveys were given access to the CD app. This was to ensure that participants correctly followed the study procedures. Moreover, students were allowed to use the CD app to track a single assignment each. Upon completing the piloting of the CD app, participants were then re-administered the K10 survey. All surveys were delivered online using the SurveyMonkey platform (SurveyMonkey, 2020). The number of times participants logged into the CD app was also tracked by the app.

3.2.2. Qualitative Data Collection

A purposive sample of eight was drawn from the primary quantitative sample (n = 16) to participate in Exit individual interviews (see Appendix B: individual interview guide) to elicit in-depth information on their user experience with the CD app. These individual interviews

provided participants with the confidentiality needed to share their unique experiences. All interviews were conducted virtually via the Cisco WebEx video conferencing platform. Each interview began with an exchange of pleasantries to build rapport and get participants comfortable with the interview setting. After introducing each participant to the study and the interview structure, their verbal consent to audio-record the interview was sought. Also, each participant was allowed to ask any lingering questions before the commencement of the interview. Each interview lasted between 15 to 30 minutes long. Participants' views were explored on different aspects of the CD app, including its perceived engagement/intractability, functionality, aesthetic appeal, informational quality, and other related subjective quality properties. Issues raised in earlier interviews were also followed-up on in subsequent ones to investigate emerging patterns and reach saturation on specific topics. When ending each interview, participants were allowed to comment on any other issues that were not raised during the interview process.

Figure 3.2: Phases of the Study



3.3. The Curriculum Densitometer (CD) Web Application

The CD app is a new web and mobile phone-based curricular assignment time tracker that can be accessed via the Internet on any brand of personal computers and smartphones. The CD app was designed to enable instructors and students to perform several course-related functions. Both students and instructors will use the final version of the CD app. An instructor can create new course assignment timers (referred to as activities) in the app and input the expected activity time load and a corresponding stress estimate (i.e., how stressful s/he thinks the activity will be for students), and enter a start date and end date. After accessing the app, a student will see the homework timer assigned by the instructor. Whenever the student starts to work on the given activity, s/he will start the app to begin tracking time spent on the task. S/he can pause the timer when going away from the task and resume the timer when working on the activity. Once done with the activity, the student will mark the given activity as completed. S/he will be directed to a

stress estimate Likert scale ranging from 0 – 10 points on a vertical slider. The student can input any level of perceived stress experienced during working on the given activity. On the instructor dashboard in the app, the instructor can see bar charts of the average time spent by all students on each assigned activity and their reported perceived stress, respectively. The stress rating scale and interpretation/descriptors were adapted from Kessler's Psychological Distress Scale (Kessler et al., 2002).

3.3.1: Development of the CD App

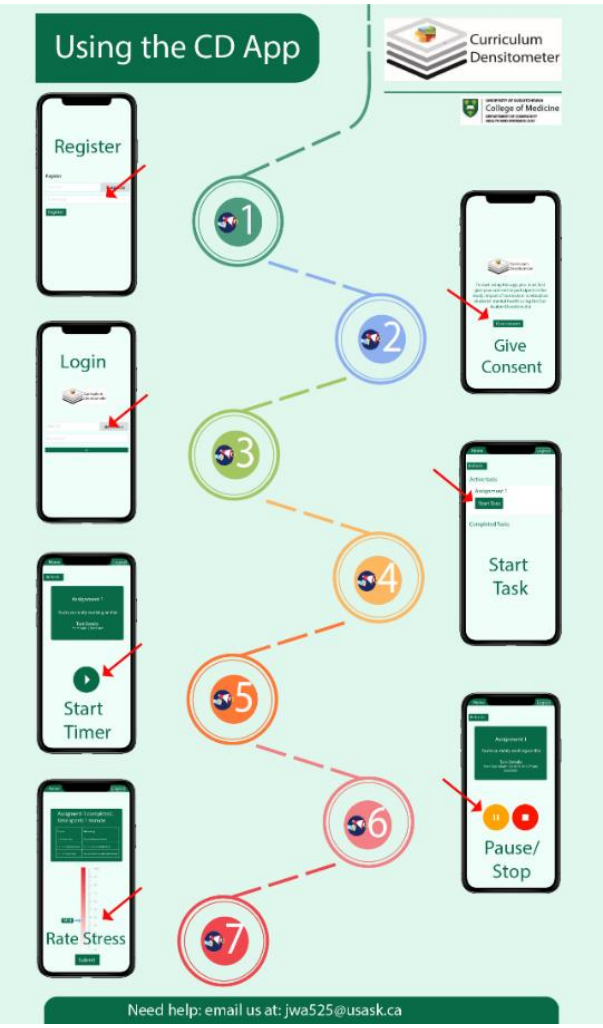
The development of the application involved several phases. The CD app was previously designed and developed by students of the Computer Science class at the Saskatchewan Polytechnic. However, due to several limitations identified with the earlier version of the application, there was a need to redesign it for this study. After the initial conceptualization of the application, the subsequent phase involved a feature gathering group discussion between the team from the Computer Science Department (Dr. Ralph Deters and Mr. Thai Lee (MSc student)) and the Department of Community Health and Epidemiology (Dr. Kalyani Premkumar and Mr. Jeremiah Acharibasam (MSc student)). After this phase, Jeremiah Acharibasam re-designed the user interfaces for both the student and instructor web applications based on earlier feedback. Then, Thai Lee (the software developer) coded the application based on the user interface designs. This process was followed by a series of review meetings between the two teams to provide feedback for modifications of the application's initial designs. These efforts led to the first pilot version of the application, which was reviewed and endorsed in a separate meeting between the two teams to be made available to participants. As a new application, participants were experiencing the CD app for the first time in this study.

3.3.2. The Student Web App

The student web app (see Figure 3.3, p. 24) was designed to automatically track their time as they worked on their school assignments and rate their perceived stress linked to these assignments once they were done. To access the application, students first had to provide consent to participate in the study. Afterwards, they were provided with a sign-up (and log-in) page to create a new account or log in to access the time trackers for their respective assignments. On the student application's home page, the active and completed tasks are displayed to students, and a

help button is made available on how to use the app. To track an ongoing assignment, a student had to click on the respective time tracker bearing the name of the given homework, which will take the student to the time tracking page with “Play,” “Pause,” and “Stop” buttons for manipulation of the time recording process. The students are provided with a stress rating scale to report their perceived stress whenever they click on the “Pause” or “Stop” buttons. Clicking on “Stop” implied the student had completed the assignment and submitted their final overall perceived stress rating. The student is then redirected back to the home page, where they would see the work they just tracked under the completed tasks section. Clicking on any given completed task would display summary data of the time spent on the given assignment and the average stress reported for that activity.

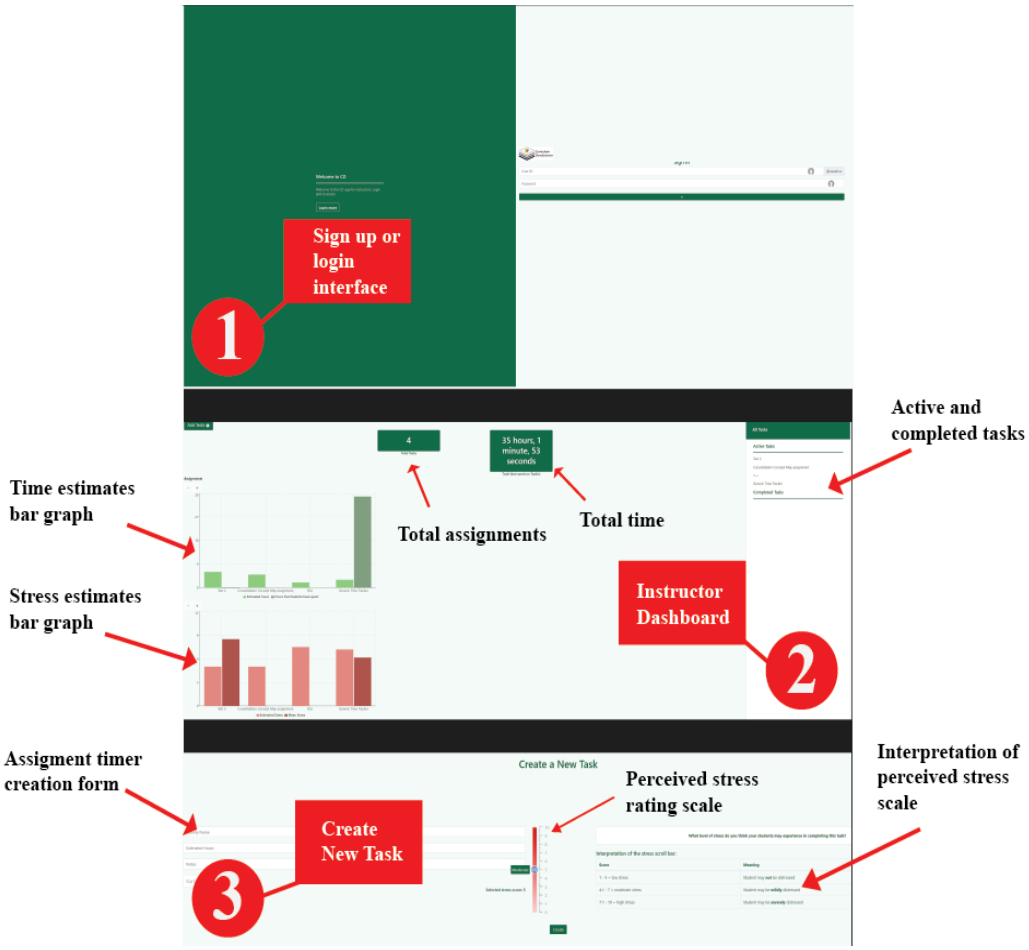
Figure 3.3: Student web app



3.3.3. The Instructor Web App

Like the student web app (see Figure 3.3, p. 24), the instructor web app (Figure 3.4, p. 25) requires the instructor to give consent to participate in the study before he or she can use the app. The instructor is provided with a registration (and log-in) page where a new account can be created, or old users can log into the application. Once signed in, the home page displays the number of assignments created, the total amount of time spent by students on all assignments, completed assignments, active assignments, and bar charts of aggregate data on students' time and stress reports. The instructor can add new assignment time trackers using an "Add Tasks" button.

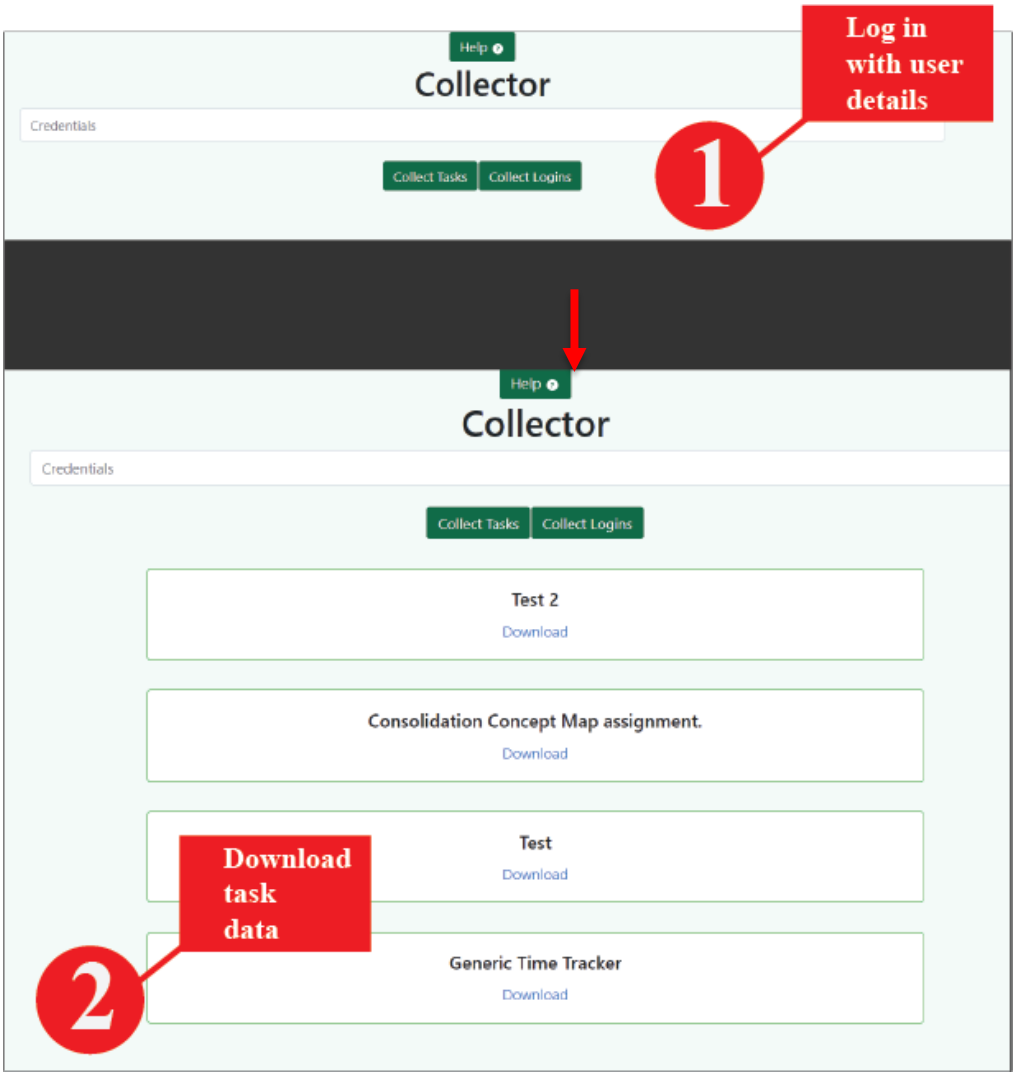
Figure 3.4: Instructor web app



3.3.4. Data Collector Web App

Stakeholders can access the data being collected by the CD app through the Data Collector Web App (see Figure 3.5, p. 26). This app was created purposefully for the research team to gather the piloting data generated by participants. To access this application, the user will need a custom-generated username and password. The data can be easily downloaded in a comma-delimited file version.

Figure 3.5: Data Collector web app



3.4. Research Setting (s)

This study was conducted in two colleges (Medicine and Nursing) within the University of Saskatchewan, Saskatoon, Canada. The College of Medicine is the University's medical school and the only one located within Saskatchewan, Canada. The College of Medicine currently has fourteen academic departments, three clinical divisions, and one school (School of Rehabilitation Science). In contrast, the College of Nursing is a non-departmentalized college at the University of Saskatchewan. It runs a distributed college system operating as a single academic unit with three campuses located within the Saskatchewan province (i.e., Saskatoon, Regina, and Prince Albert). As of the 2019/2020 academic year, the Colleges of Medicine and Nursing both had a total student population of about 1,165 and 1,152, respectively (U of S Information and Communication Technology Reporting and Data Systems, 2020). The two colleges offer both postgraduate and undergraduate health sciences programs.

3.5. Participants

Before the pilot study, the CD app was initially demonstrated to an audience of nine participants (6 instructors, one curriculum developer, one undergraduate student, and one postgraduate student) at the 2019 Research on Teaching and Learning Conference organized by the MacPherson Institute, University of McMaster, Hamilton, Ontario. These participants were also surveyed using an open-ended questionnaire on the CD app's feasibility after the demonstration exercise.

Out of the initially estimated pilot sample size of 100 participants, a volunteer sample of 16 students (2 undergraduate and 14 postgraduate) were recruited from the spring, summer, and fall 2020 courses within the Colleges of Nursing and Medicine, University of Saskatchewan. A total of 16 (instead of 100) participants were recruited for this study because of participant recruitment challenges that were encountered during the commencement of the data collection phase, which coincided with the emergence of the COVID-19 pandemic. The sample of 16 participants included only students who were enrolled in the courses used, participating in a given course-related assignment, willing and able to provide informed consent, and owned a personal smartphone or computer.

3.6. Recruitment Procedures

The data collection phase commenced on March 3, 2020, and ended on September 20, 2020. To involve an academic course in the study, the instructor(s) of each class were contacted by the researcher via email to introduce the research and seek explicit consent to recruit the students in the given course into the study. For the College of Nursing, the recruitment email and other materials, including a custom-created CD app poster (see Figure 3.3, p. 24), and links to the online pre-test and post-test surveys and the CD web app, were sent out by the program administrative assistant to the students. Of the total of 5 courses approached, four instructors agreed to involve their courses in the study over the spring and summer 2020 semesters (2 from College of Medicine, two from College of Nursing). Two of the four courses were undergraduate courses, and the other two were postgraduate courses.

Of the four courses involved in the study, five students from two of the courses volunteered to participate in the study (two undergraduate students and three postgraduate students) from the College of Nursing. Subsequent follow-up recruitment through snowball sampling yielded an additional sample of eleven participants from alternative courses during the summer and fall 2020 semesters within the colleges of Nursing and Medicine. Thus, a total of 16 participants were recruited for the study.

3.7. Outcome Measures

This implementation pilot study's primary outcome was the feasibility and acceptability of the CD app. The secondary outcome was to examine the association between students' psychological distress self-reports on the K10 (Kessler et al., 2002) and their results on the CD app's perceived stress scale [see Appendix A]. An open-ended semi-structured interview guide adapted from an existing mobile app assessment instrument was used to elicit qualitative data via individual interviews (Stoyanov et al. 2015) [Appendix B]

3.8. Factor(s) Measures

The study's main predictor was curricular workload (measured as the automatically tracked time duration a student spends to complete a given course assignment). The covariates were student demographic characteristics (Appendix C).

3.9. Data Analysis Procedures

3.9.1. Quantitative Analysis

The quantitative statistical analysis was conducted via the SPSS software [version 25] (IBM Corp, 2017). Descriptive statistics of the participants' demographic characteristics (age, sex, year of the study, the study program) and the CD app's feasibility technical benchmarks were computed.

The nonparametric Spearman's Rank-Order Correlation test was used to investigate the association between the perceived stress scores obtained by the CD app and participants' scores on the K10 questionnaire (Kolassa, 2020). Differences between participants' pre-and post-test scores on the K10 questionnaire were also assessed using the nonparametric Wilcoxon Matched-Paired Signed Ranks statistical test (Kolassa, 2020).

3.9.2. Qualitative Analysis

The qualitative feasibility and acceptability aspects of the CD app were explored via individual participant semi-structured interviews. Thus, Nvivo (version 12) was used to conduct a qualitative analysis of the interview data (QSR International Pty Ltd., 2020). After transcribing the interviews, each participant was privately emailed a copy of his/her personal interview transcript to verify and confirm that it authentically represented his/her own voice and make corrections where needed. Only one of the eight participants made minor corrections to her transcript. My supervisor also verified each copy of the transcribed documents against the audio-recorded interviews for accuracy.

The transcribed data were subjected to Braun and Clarke's (2006) reflexive thematic analysis approach to examine and discuss the semantic themes (i.e., the patterns of meaning) emerging from the data. First, I familiarized myself with the data by reading and re-reading the completed transcripts. Secondly, initial codes were generated based on the identification of unique features that emerge from the dataset. Thirdly, I searched for themes that arose from the clustering of the codes previously generated. The fourth step consisted of a careful review of the formulated themes to ensure they matched the extracted codes. In the fifth analysis phase, the emerging themes were defined and named. The code generation, clustering, and naming phases were

iterative. The student researcher, Jeremiah Acharibasam, performed the initial coding, clustering, and naming of themes, which were then reviewed and corrected by the academic supervisor, Dr. Kalyani Premkumar. This process was repeated several times until a satisfactory agreement was reached between the two researchers before moving on to the last data analysis phase. The qualitative analysis ended with a write-up of the results to provide contextual explanations for the quantitative findings.

3.10. Ethics Approval

Ethics approval (Application ID: 1457, see Appendix D) for this project was obtained from the University of Saskatchewan Behavioural Research Ethics Board (Beh-REB). Also, an operational ethics approval was obtained from the College of Nursing to gain access to courses within the College of Nursing (see Appendix E). The changes to the design of the study, explained earlier (p. 19) (due to pandemic crisis) were also approved by the Beh-REB before the study was implemented.

3.11. Summary

This chapter details the methodology, including this study's philosophical worldview, study design, description of the technological application piloted, setting(s) description, participants and recruitment procedures. It also presents information on the study's outcome measures, factor(s) measures, data analysis procedures, and ethical considerations.

CHAPTER FOUR

RESULTS

4.1. Introduction

This chapter presents the quantitative and qualitative findings of this study in the context of the study's research question and hypotheses. The quantitative results include the participants' descriptive statistics, the association between the CD apps' perceived stress scale and the K10's scale, the CD app's technical feasibility, instructor participation, and description of the assignments used. The qualitative results consist of several themes on the acceptability and feasibility of the CD app obtained from the qualitative interview data. The chapter ends with a summary of the main findings of the study.

4.2. Participants

This implementation pilot study's primary purpose was to explore and better understand the Curriculum Densitometer web application (CD app) among post-secondary health sciences students. The study involved a total of 16 participants (see Table 4.1). The majority of the participants were female, international graduate students, 30 years and above. Participants were mainly from two health professional areas in the University of Saskatchewan: Nursing (the majority) and Community Health and Epidemiology (Epi.), College of Medicine.

Table 4.1: Participant Demographics

Variable	n (%)
Age (years)	
20+ <26	4(25)
26+ < 30	2(12.5)
30+ <36	5(31.3)
>36	5(31.3)
Gender	
Female	11(68.8)
Male	5(31.3)
Education	

Undergraduate	2(12.5)
Graduate	14(87.5)
Health Profession Education	
Nursing	11(68.8)
Community Health & Epi.	5(31.3)
Student status	
Domestic	3(18.8)
International	13(81.3)

4.3. Quantitative Results

4.3.1. Association Between the CD App.'s Perceived Stress Scores and the K10 Scale

The present study's results support the hypothesis that there is a correlation between participants' perceived stress scores on the Kessler Psychological Distress Scale – K10 (a widely standardized measure) and their scores on the CD app's perceived stress rating scale. The Spearman's Rank-Order Correlation analysis showed a significant positive association between participants' post-test K10 scores and the CD app's perceived stress rating scores ($r(12) = .560$, $p = 0.00$) [see table 4.2].

Table 4.2: Association Between the CD App Stress Scale Scores and the K10 Scale

Variable	1	2	3
CD app stress scores	_		
K10 Pre-test	0.480	_	
K10 Post-test	0.560*	0.319	_

Note: * Correlation is significant at the 0.01 level (1-tailed). $N = 16$

However, a Wilcoxon Matched-Paired Signed Ranks analysis did not find any significant differences between participants' pre-and post-test scores ($Z = 1.33$, $p = .184$). Statistical analysis

showed no meaningful relationships between participants' time spent on their school assignments and their stress ratings. There was also no significant difference between the instructors' estimates of time versus students' actual recorded time spent on their CD app assignments. Similarly, no significant differences were found between students' and instructors' perceived stress estimates.

4.3.2. Technical Feasibility of the CD App

The study's primary hypothesis was to examine the technical feasibility of the CD application based on user interaction (measured by log-in rate) with the app. The results showed that the CD app had high technical feasibility. Of the 16 participants who used the CD app, most of them showed a high engagement rate. There was an average of 3 and a total of 39 sign-in activities. Most of the technical feasibility benchmarks were thus either met or exceeded during the piloting of the application [see Table 4.3]

Table 4.3: Summary Statistics of the CD App Technical Feasibility

Benchmark/Metrics	**Expected Number Estimates During the Piloting Period**	
	Minimum Expected	**Actual Recorded**
Registered user accounts	All participants (16)	16
App log-ins (per user)	Average of 2 sign-ins	Average of 3 sign-ins (39 total)
App crashes reports (Self-reported/automatically logged)	2	6 participants reported errors 1 automatic crash
Logged hours recorded in the app	At least10 hours in total (out of total participants)	156 hours in total
Stress and time estimates (number of participants self-reporting)	All participants(16)	All participants(16)
Completed assigned activity	All participants	All participants

4.3.3. Instructor Participation

A total of four instructors provided time and stress estimates for the assignments used in this study from their courses. The undergraduate nursing course (NURS 307.3) was taught by three instructors, of which only two students of the three instructors participated in the study. Also, no student from the MEDC 216.18 undergraduate courses volunteered to participate in the study. Therefore, only students of two assignments from the NURS 307.3 course were included in the CD app's piloting.

4.3.4. Assignments Used

The first assignment was a 40 question-multiple choice assignment (called Exam 2) given to undergraduate students of the 307.3 class to complete remotely on the Internet. The second assignment (called Assignment 4 –Introduction and Literature Review) was offered to students who were enrolled in the 892.3 graduate class. For this assignment, students were expected to revise an earlier assignment, write a one-page literature review, and create a pinch table to be used for guiding their critical appraisal and summary of relevant evidence. This assignment was based on assigned readings and other in-class activities. In addition, a generic assignment group was later included in the study comprising of diverse assignments being completed by the student-volunteers recruited into the research via snowballing from the College of Nursing and Community Health and Epidemiology. These students were completing their respective assignments for courses they were enrolled in during the 2020 spring semester. Seven of these participants used the CD app for an assignment requiring them to write a research proposal. Simultaneously, the rest piloted it with an assignment requiring them to create indicators for COVID-19 (please see Table 4.4, p. 35-36 for details of the assignments used).

Table 4.4: Summary of Details of the Assignments Used

Course Code	Assignment Description	Instructor(s) (estimated)			Participants (reported)		
		Time	**Stress**	**Total Instructor-(s)**	**Time ($\bar{x}$)**	**Stress ($\bar{x}$)**	**Total Partici-pants**
NURS 307.3	**Name: Quiz # 3** Quizzes: There are three quizzes in this course that are to be completed through blackboard. The quizzes are meant to test knowledge for designated chapters, and they replace mid-term and final exam.	1-hour	6/10	3	2 (hours)	5.0/10	2
	Name: Exam # 2 40 questions - multiple choice, based on assigned readings and in-class activities. Exams will be written online in Blackboard.	1-hour	8/10				
	Name: Quiz The Quiz is 40 multiple choice questions, and they have 1 hour (60 minutes) to complete. If the student has accommodations, they receive an additional 30 minutes.	1-hour	7.5/10				

NURS 392.3	**Name: Introduction and literature review** In this assignment, you will build upon the feedback provided in Assignment 2 and performing a literature review relevant to the topic. In this assignment, you should demonstrate a good understanding of your chosen topic and how different components of a proposal inform each other including literature review.	1-week (168-hours)	6/10	1	35 (hours) 1- day	4.8/10	3
MEDC 216.18	**Name: Consolidation Concept Map** Using a concept map design, organize and link critical concepts of the course (basic science/clinical) to explain each group's clinical problem. The concept map and presentation will be assessed using a scoring rubric. Any recording software can be used to present your work.	4 (hours)	8/10	1	-	-	0
Generic	Seven of these participants used the CD app for an assignment requiring them to write a research proposal, while the rest piloted it with an assignment requiring them to create indicators for COVID-19.	-	-	Multiple	2 (hours)	5.4/10	11

4.4. Qualitative Results

The research question was to explore how feasible and acceptable participants perceived the CD app for measuring C.O and perceived stress. The qualitative thematic analysis produced several emergent themes relating to the CD app's acceptability and feasibility. Interviews were held with 8 participants (2 male and six females). The themes derived from the data were organized under the broader themes of acceptability and the CD app's feasibility.

4.4.1. Acceptability of the Curriculum Densitometer Application

Seven key themes emerged from the data regarding participants' acceptability of the CD app. The participants' acceptance of the app revolved around certain factors including, strategic use of aesthetic appeal, stimulating user self-reflection, enabling curricular equity and resource support, catering for different users, considering particular pull and push factors, collaboratively improving the app with user feedback, increasing the personal value of the app to users, and addressing data confidentiality issues.

4.4.1.1. Strategic Use of Aesthetic Appeal to Increase User Acceptance

This theme captured participants' perception of the CD app's aesthetic appeal, precisely, the role of colour and minimalistic design in eliciting user trust, extrinsic motivation to use the CD app, and positive experience with the app. However, some participants felt that the user interface needs more work to increase extrinsic motivation to patronize it. Others also requested to compliment the icons on the app with text labels

> "*I am a student at the University [University of Saskatchewan], and green happens to be the colour of our logo; hence you couldn't have chosen a better colour."*

> *"... it was user-friendly, it was not too much… I think the simplicity of that [the CD app], I think, especially, the intention is not to add more stress for folks.."*

4.4.1.2. Stimulating User Self-Reflection as a Path to Increasing Acceptance

This theme encapsulates individual participants' ideas about what the CD app meant to them. Some saw it as a mindfulness tool for self-reflection and self-awareness, while others felt it was a way to help them keep track of their time spent doing schoolwork:

"…I think it just brings more awareness into our habits and practices, and then you can make a change based on that…. I think it is kind of like a tool for mindfulness...."

"…you don't really keep track of how much time, all the times that you just pull up a paper or sit and just download a few articles, it doesn't seem like a long time, then all of a sudden you are like, oh my God, that was two hours I started!"

4.4.1.3. Users Need an Advocacy Tool for Curricular Load Equity and Adequate Student Support

Another relevant acceptability theme, although unexpected, was participants' keenness to use the data generated by the app to engage with instructors on curricular load fairness and creating support for struggling students. But one participant also cautioned that the application could produce a false sense of reality among students and lead to victim-blaming among stakeholders.

"I think they [instructors] forget how long it takes to do something like a simple discussion post or any of thirty of them in a week like it is a little bit much! … Yes, and make them more even… it would be fairer if all the classes had equal workloads…"

"…I would be really curious to know for folks that may have a diagnosis of ADHD[Attention deficit hyperactivity disorder], or if focusing and concentration are challenging, how a program like this would be beneficial."

"…I don't know whether it would give a false sense of reality ... if there is an expectation that this assignment, like, x assignment takes x amount of time and if you are above or below does that then reflect on the student, or the assignment, or does it reflect on the professor?"

4.4.1.4. Acknowledging and Catering for Different Users

A central theme among all participants was recognizing and catering to various users and their needs. For instance, some participants felt the application was best suited for students with poor time management skills or hectic schedules. Others felt that productivity-focused and

technologically advanced students would benefit most from the application, while a third group believed that anyone, including new students, could use the application.

> "*...people that struggle more with time management ...and they still have a lot of things going on...[and]…people interested in productivity…."*

> "*I think anybody can use it… Knowing technology is okay, but … you don't need to have much technical knowledge; if you can use the phone, you can use that app."*

4.4.1.5. Certain Pull or Push Factors will Increase or Decrease User Acceptance if Neglected

This theme captured several contextual and personal factors that would increase the CD app's likely uptake among different user groups. The feedback provided on time and perceived stress, and ease of use of the app were essential to a positive user experience and uptake. Also, seeking user feedback and providing personalized self-care recommendations were vital determinants in willingness to use the app and to recommend it to other students in the future. Furthermore, the simplicity of navigation, flexibility of recording the time, ability to save previous user sessions, and the user onboarding resources provided were critical pull factors. However, participants were concerned that making the app too customizable could increase user transaction cost. Others also expressed dissatisfaction that the app was not integrated into their workflow.

> *"….it was easy to use, all you had to do was hit play, and I can get that!"*

> "*... the feedback would be what kind of keeps people, or me anyway, and it is what keeps me engaged when using it…"*

> "*…that it is prescriptive, there is no action…I would like to know about* my *stress level when writing, but then I don't know how much value just this information would be for students…"*

4.4.1.6. Meeting User Needs Would Increase the Personal Value of the App

Participants' responses also revealed an underlying theme that the CD app's subjective value was tied to the perceived uses of the data generated. Many reported that the app was a tool

for keeping focus on the task, self-improvement, and future academic planning. Others felt it was more useful for behavioural self-care.

> "*I think it is a way of keeping students on track… I kind of feel it put a little bit of a fire, like a little bit of motivation...*"

> "*…it will help them to know their strengths and weaknesses in preparing for assignments…it gave me an idea of how long I could stay on a particular assignment…"*

> "*…I would definitely suggest it… in this time of COVID…it is very good if people are using this app to track their time and to understand their stress level…*"

4.4.1.7. Unintended Consequences of Data and the Need for Privacy and Confidentiality

Concerns of data privacy and unintended consequences of access to students' data on the CD app was a major theme. For example, some participants pointed out a potential case where student users could misrepresent data to gain curricular favour. Another participant also raised concerns about creating unintended, unconscious grading bias among instructors. To avoid these issues, participants suggest data should be made anonymous on the CD app.

> *"…if the students knew that the instructor was looking, they may falsify their accuracy and try to get their assignments lessened."*

> *"…but I do think that there would be unconscious bias for sure…suppose I had seen that someone had spent four hours on an assignment versus ten minutes … it could impact how I graded it…."*

4.4.2. Feasibility of the Curriculum Densitometer Application

In terms of feasibility of the CD app, four themes were derived from the data: the diversity of sources of perceived stress and subjectivity of perceived stress, the unreliability of human memory in keeping time, combined impact of all components on the app's feasibility, and the need to further improve the app to increase usage.

4.4.2.1. The Diversity of Sources of Stress and the Subjectivity of Self-Reporting

This theme represented participants' concerns about the reliability of the CD app's perceived stress reports and how these could be further enhanced. Most participants felt that the app measured some level of perceived stress. However, many also indicated the subjective nature of this form of assessment. Participants suggested several options to enhance the authenticity of the perceived stress scores, including tracking multiple courses and using motion and biometric sensors.

> *".. It will measure some level of stress but not accurate…. It depends on what stress you are going through. If the stress relates to the assignment or in-between the assignments, if you had a phone call or there is a conversation or even the environmental factors could lead to stress. So, you would rate it as stressful, but not really. And, it could also go the opposite way, you could be stressed, but you wouldn't see yourself as stressed as compared to if a body sensor feels that*."

> "*…people may not write what they feel but write what they feel is acceptable to society."*

> "*… I think if you use the app to track two courses, it will actually give you a better idea because different assignments come with different stress levels…"*

4.4.2.2. Unreliability of Human Memory and the Difficulty of Keeping Time

This theme articulates some of the challenges related to measuring the time spent on an assignment among participants. One main problem was participants forgetting to track their time when starting or during the completion of an ongoing assignment work. Participants offered several potential solutions to help resolve this problem, including allowing manual tracking of time, using motion sensors, building the CD app into the student workflow, and introducing event-triggered notification alerts in the app.

> "*I am not sure about the time …I forgot that I had the time tracker on… it is less likely that the time truly reflects the accurate time used for the assignment."*

> *"…if you have sensors…When you are even stretching within a certain radius, the sensor can sense your absence or presence*."

4.4.2.3. New User Requirements and Strategic Distribution

This theme underlines several recommended features and potential avenues to distribute the CD app to increase its feasibility and uptake. Generally, most participants felt the CD app met its functional expectations with a regular rating of eight on a zero to ten scale. However, one participant would prefer if the app allowed her to create her tasks, set her timers, filter tasks, and these tasks should be presented in customizable columns format. Other requested features included having alerts, reporting the data in graphical format, and ensuring that accessing the app is low financial cost to students and its distribution is affiliated to academic institutions.

> "*…it would be cool to be able to break tasks down or even if you can make it like a calendar and then the dates…and then kind of click it and see where things were lining up…"*

> "*…two things that would probably motivate use is: if it is a free downloadable app… or if it is also attached to academic institutions…"*

4.5. Summary

This chapter presented the results of the quantitative and qualitative data analysis of the study. This study's primary finding is that there is currently some feasibility and acceptability for the CD app. However, the technology still needs to address several concerns to gain broader user adoption. Specifically, it was found that although the CD app's perceived stress scale had a moderate correlation to the standardized Kessler's Psychological Distress scale, although participants still viewed it as less objective. Regardless, the quantitative analysis revealed a high interaction with the CD app, demonstrating some level of feasibility and acceptability of the technology among participants. Also, several themes emerged from the data regarding the acceptability of the technology, including enhancing its aesthetic appeal, facilitating users' ability to focus on tasks, creating features in the app for curriculum equity advocacy, addressing data security and privacy, catering for diverse users and needs, considering the pull and push factors, and investigating the unintended consequences of the data generated. In terms of feasibility, it was discovered that the subjectivity of self-reported behavioural data, the dependency of self-reported measures on human memory, and addressing new user requirements were essential to a successful implementation process. Overall, the CD application is considered a promising technology for measuring curriculum overload and student perceived stress among the post-secondary health sciences students in this study.

CHAPTER FIVE

DISCUSSION

5.1. Introduction

This chapter provides a discussion of the main findings of the study. The limitations and some recommendations for future studies are also presented in this section. The chapter ends by drawing conclusions based on the findings.

Taken together, the findings reveal an acceptability and feasibility among student users for the CD app. However, several underpinning user adoption dynamics need to be considered. The findings also strongly suggest that there are immediate practical applications for the CD App, which will have many implications for curriculum development, classroom management, teaching and learning, and student academic success. However, it is interesting that the technology can also have many unintended data privacy and confidentiality consequences which can impede teaching and learning and ultimately affect student academic progress. Considering the complexities in the process of health sciences curriculum development, teaching and learning, and student-instructor relationships, introducing any curriculum-related technology aiming to transform this process will have to be context-sensitive to gain a broader user acceptance and greater adoption.

5.2. Acceptability of the CD App

5.2.1. An Advocacy Technology

This study found some central themes that highlight many critical aspects of stakeholder agreeableness and subsequent adoption of new and unfamiliar technologies (Procter et al., 2011). Although the main focus of this study was on assessing a new technology, it was found that the participants consistently saw the CD app as a tool that can be used to advocate for equitable sharing of curricular workload by instructors. In other words, this finding shows that students perceived a gap between their actual lived experiences and their instructors' understanding of a student's lived circumstance. To explain this using the Unified Theory of Acceptance and Use of Technology (UTAUT), participants' perception of the CD app as an advocacy tool indicates its perceived usefulness to them and hence, they are likely to adopt it (Venkatesh et al., 2003). The

finding also shows that student suffering from perceived stress was, perhaps, linked to a sense of unfairness in curricular workload distribution (especially in courses taught by multiple instructors). Students' experience of stress has already been associated with specific curriculum components, including the amount of academic work, simultaneous hand-in assignments and deadlines, and low academic support (Lindsay, & Rogers, 2010; Sweller et al., 2019; Naidoo et al., 2014). Thus, this finding shows that participants see the CD app as a means to identify and communicate these components to their instructors. This is an important finding as it shows that the CD app can be used within the health promotion student mental health approach to identify and target specific curriculum elements that may be associated with poor student mental health for curriculum innovation (Salvin, Schindler, & Chibnall, 2014).

Although no significant differences were found between students and instructors perceived stress estimates on the CD app, students' psychological distress scores on Kessler's psychological distress scale (K10) were significantly associated with their scores on the CD app. This finding shows that the CD app's stress scale has some concurrent validity with the K10 scale (Kessler et al., 2002), although this requires a more comprehensive validation because of the problematic nature the accuracy of self-reported data on smartphone devices (Murakami et al., 2016; Toon et al., 2016; Bhat et al., 2015; Hwang, 2020). A contrary interpretation may also be that students were motivated to express their perceived stress on the application because they felt that instructors having access to this data meant an opportunity to inform these instructors of their suffering of stress which can get the instructors to appropriate balance their curricular load. This points to user intent and motivation as a potential limitation to the validity of the CD app's perceived stress scale. However, it equally draws attention to how the technology's perceived value as an advocacy communication tool could influence a broader student acceptance and high adoption of the technology.

Also linked to advocacy was participants' views on the relevance of the time recorded data on the CD app to helping instructors identify and support academically struggling students, especially those with various learning disabilities. A consensus was found among participants that the time data from the app would provide instructors with a way to identify students taking longer to complete curricular tasks to provide these students with whatever academic support they needed. This pattern of thought among participants does agree with earlier evidence which

indicates that suffering of perceived stress, to some extent, is related to mental adaptability of individual students (Egnew et al., 2018; Ellaway et al., 2014; James et al., 2017; Kötter et al., 2017). As shown by existing literature, the CD app bridges a relevant gap in helping instructors understand how long students take to complete course tasks which can help in appropriately balance curriculum load (Barre, 2016). Although perceived stress related to curricular overload among students with special needs was beyond the present study's scope, speculation is that these students may experience significantly more perceived stress than the average student. Therefore, it will be interesting to examine the feasibility of the CD app among this particular group of students in a future study. With the ubiquity and frequent use of mobile devices and the Internet among health sciences students (Lattie, Lipson, & Eisenberg, 2019), the CD app may become an essential tool for facilitating student-instructor communication and classroom management.

5.2.2. A Mindfulness Technology

Another intriguing theme that emerged in this study involved participants' perception of the CD app as a tool for staying mindful of one's daily life routine and habits. Most participants cited having to multitask to meet academic demands frequently. According to Alkahtani et al. (2016), multitasking involves the performance of more than one task in parallel or rapid transition. In the context of this study, students used the term multitasking to indicate the cases where they tend to simultaneously engage in other activities (including working on other academic tasks) while completing a given academic task. Several studies have shown that multitasking during academic-related work can be detrimental to learning and performance (Alkahtani et al., 2016; Mark, Wang & Niiya, 2014). For instance, Alkahtani et al. (2016) showed that multitasking prolongs the time spent on academic tasks and reduces student grades. Also, Mark, Wang and Niiya (2014) found a positive correlation between stress and heavy multitasking and that college students tend to multitask more frequently.

Similarly, May and Elder (2018) also showed that multitasking reduces attention and working memory, negatively affecting students' recall, comprehension, note-taking, and test performance. Thus, one interpretation of this finding is that using the CD app brought these participants some insight into their multitasking habits. The finding also reveals that most of the participants had a desire to simplify their daily academic life circumstances and believe that the awareness achieved by the simple act of tracking their time on daily tasks could help them gain

some level of focus. Again, this theme supports earlier studies that argue that some aspects of the curriculum are linked to students' perceived stress and further reveals that having to multitask and feeling overburdened are consequences of curricular overload (Altaf et al., 2013; Hill, Goicochea, & Merlo, 2018; Reed et al., 2011; Smith et al., 2007; Sreeramareddy et al., 2007). Contrary to prior evidence on students' mental adaptability (Egnew et al., 2018; James et al., 2017), this study finds that awareness of one's curricular load may influence certain adaptation behaviours, including excessive multitasking among students which could lead to perceived stress. However, the finding is consistent with evidence that stress has multiple sources (Avdija, 2018; Hill & Maerlo, 2018).

Furthermore, as pointed out by some participants, multitasking may be more of a problem for students with difficulties in time management and hectic schedules (Ellaway et al., 2014; Heinen et al., 2017; Reddy et al., 2018). Thus, as the curriculum load continues to grow and students strive to simplify their daily lives, there will be a broader acceptance of the CD app as it serves an essential self-care need. According to the UTAUT, a technology that is seen to have job relevance and perceived usefulness is likely to increase user behavioural intention and actual use behaviour (Venkatesh et al., 2003). The observed high technical feasibility (user interaction) with the CD app provides evidence to this claim.

5.2.3. The Value of Data and the Unintended Consequences

The value of data and unforeseen consequences was also a compelling theme that emerged from the data. This was more of an issue of tension among participants regarding weighing the risks versus benefits of implementing the CD app. A consensus among participants was that the CD app was an excellent tool for focusing on tasks, identifying personal academic weaknesses, planning schoolwork, and stress management. However, most feared that the app's data could also create unconscious grading biases among instructors and be used by students to manipulate instructors into unnecessary curricular modifications. This finding touches on broader social issues of the dangers of technology and data privacy and confidentiality that can hurt user trust and impede innovation adoption (Marakhimov & Joo, 2017). As Bauer et al. (2017) indicated, self-monitoring devices like the CD app can be perceived as overly intruding. Some participants in this study were concerned that their instructors may be looking at their self-reported data. Many of them also supported the idea of de-identifying the data instructors had

access to. Taken together, one interpretation of this finding is that user trust is inextricably linked with concerns of personal data security, anonymity, and sense of the other. Thus, building inherent transparency into the technology via user involvement is essential to reduce concerns regarding user privacy and confidentiality breaches (Venkatesh et al., 2003). Though, it did appear that participants were accepting of the technology if its value to their circumstances outweighs the potential dangers it poses.

5.2.4. All Users are Not Equal

The CD application users will not be a homogenous group, and a diverse array of user personas and user needs must be catered for. This finding supports the UTAUT's view that user technology adoption variance is explained by broad social contextual factors and personal-level demographic characteristics (Venkatesh et al., 2003). The majority of the participants unanimously agreed that the application's value was tied to each student's unique situation, which will influence their acceptance and use of the technology. Whereas many believed that people with time management or scheduling difficulties would accept and use the technology, others felt those keen on productivity, high technical skills, and first-year college students would be the best user categories. However, a third group argued that the CD app could be an application for every student. This theme touches on the issue of self-efficacy and goal completion (Bandura, 1977). The theory of self-efficacy is essential to the present study in understanding user technical capacity to adopt and successfully use the CD app. For instance, user adoption of the CD app will be greatly influenced by their ability to use the technology to achieve a given task (i.e. track time and rate perceived stress) and the expectations of outcome related to personal or performance benefits (Bandura, 1986). Moreover, rating of users' stress on the CD app is inextricably linked with their self-efficacy level as self-efficacy is a major determinant of one's psychological resilience when experiencing life stress (Bandura, 195, p.2; Locke & Bandura, 1987). Conversely, having low self-efficacy can be detrimental to the adoption, and successful use of the CD app as the motivation to persist through stress and exert effort to complete academic tasks may be low (Shcunk, Meece, & Pintrich, 2014; Usher & Pajares, 2008, p. 751). Therefore, it is expected that each user persona's behavioural intention and use behaviour will vary based on their sense of computer-self efficacy (Venkatesh et al., 2003). This theme's underlying implication is that curricular load and perceived stress vary

across different students, and student context is an essential component of this process. In my view, this is compelling evidence for the role of demographic factors in the connection between the curricular load and perceived stress (Heinen, Bullinger, & Kocalevent, 2017; Kötter et al., 2017; Naidoo et al., 2014; Sweller et al., 2019; Smith et al., 2007). Ultimately, this finding captures the need for user involvement in the implementation process and the significance of capitalizing on early adopters' zeal to help gain a broader user acceptance of the CD application.

5.2.5. Push and Pulls of User Innovation Adoption

Technology adoption behaviour involves a positive user experience, a latent factor that consistently underlies all the findings of this study. Beyond catering to diverse needs is the sophisticated nature of nurturing a positive user experience. The study found several user experience factors either motivated or repelled participants from wanting to use the CD application in the future. For instance, it was realized that the app's different features had a combined and compensatory impact on participants' overall lived experiences with the technology. While some users felt the use of a minimalist user interface design and colours associated with the University of Saskatchewan's brand made the technology seem approachable and friendly to use, others enjoyed the navigation process's easiness and relevance of the self-monitored data. This study shows that colour as an aesthetic component can be used to communicate trust, which agrees with studies that argue for strategic use of colour to attract user attention and communicate product meaning (Kauppinen-Räisänen, 2014).

It was also noticed that navigation's easiness played a significant role in reducing user perception of transaction cost and burden of using the technology. Factors such as ease of use and value of the results produced by technology have also been reported to be strong indicators of greater innovation adoption (Venkatesh et al., 2003). If users feel that using the CD app requires a high performance and effort expectancy, they are less likely to use it (ibid). Beyond providing results, this study found that the impact of these findings in changing the user's personal circumstances is what lends actual value to the output of the CD app. For example, most of the participants in the study were concerned that the data provided by the CD app is prescriptive and would prefer that it further provided personalized stress management recommendations. Likewise, providing user feedback was an essential motivational element that made users feel involved in the innovation's creation process and impacted their likelihood to use

or influence others to use it in the future (ibid). These user perspectives suggest that practical implementation of the CD app must give users a sense of ownership of the technology by involving users in its implementation processes. When users feel in control of the innovation, it is likely to influence positive general beliefs about the new technology and its use (ibid). By involving users, they will ensure the technology is integrated into their unique daily workflows, a point raised by some participants, and prevent perceiving the application's use as an extra burden (Bauer et al., 2017; Torous et al., 2018). However, to allow users to realize their participation in this process fully, there is a need for user onboarding and technical capacity building on the use of the CD app. This is essential because it reduces computer anxiety and provides users with a sense of effort and performance expectancy, increases their technical experience, and promotes a sense of voluntariness, which are critical elements for behavioural intention and use behaviour in innovation adoption (Venkatesh et al., 2003). The implication for this study is that, the lack of a comprehensive user onboard process affected participants' ability to properly use the CD app which reflected in the technical challenges a majority of them reported during the course of piloting the app. Thus, the quality of the data recorded via the CD app may have been affected by participants' ability to properly use the CD app. This problem may have resulted in an uder- or over reporting of the time spent on the assignments and perceived stress ratings provided by the participants in this study. Addressing this in future studies can help ensure the data gathered via the CD app is more reliable and consistent.

Considering the limitations of existing technologies such as ***BlackBoard*** or ***Canvas*** (both are Learning Management System software used for curriculum by the University of Saskatchewan), an opportunity exists for behavioural self-monitoring technologies like the CD app to support students' curriculum-related mental health needs. Also, the acceptability themes point to the fact that several technical and social dynamics need to be considered in the design and implementation of the CD app, and user involvement in this process is critical to its successful acceptance.

5.3. Feasibility of the CD App

The concept of feasibility has to do with the extent to which the new solution can be successfully used or carried out within the target setting (Karsh, 2004). Beyond acceptability, the

study also explored feasibility in-depth to understand some of the underlying issues to be considered in broader technology implementation.

5.3.1. Subjectivity of Self-Reported Data and Unreliability of Human Memory

As pointed out earlier in the discussion, the quality of self-reported data is challenging (Althoff, 2017; Monteith & Gleen, 2016). It was discovered that self-reported perceived stress was considered subjective and could be influenced by social desirability. Like earlier studies, it was realized from the data that perceived stress was greatly affected by personal circumstances and varied across the different participants (Reddy et al., 2018; Sweller et al., 2019). The take away is that, it is extremely difficult to measure stress objectively, and hence this study focused on perceived stress (i.e. the degree to which an individual believes a given stressor is impacting on her/him (Kamarck & Mermelstein, 1983). It is also essential to indicate that, this study was mainly conducted among students from the College of Nursing and the Community Health and Epidemiology Master's program (College of Medicine), University of Saskatchewan, and hence the finding may not necessarily be representative of the perceived stress experience of the entire spectrum of health sciences students, especially, medical students, due to the differences in professionalism as a competency within the curriculum medical students are subjected to.

Although participants felt their self-reported perceived stress was somewhat accurate, they felt less confident about the quality of their recorded time. Most participants consistently forgot to track their time at different phases of completing their assignments. Many of them indicated the lack of notifications in the CD app as a significant contributing factor for this. Mobile technology is an excellent tool for behavioural data gathering. Still, this study provides further evidence that the multiplicity of sources of stress and human memory weaknesses are significant challenges for smartphone-based data collection (Althoff, 2017; Bauer et al., 2017; Chakhssi et al., 2018; Sweller et al., 2019). For example, while some participants raised concerns about potentially rating extracurricular stressors as perceived stress on the application during assignments, some indicated that students are likely to rate their perceived stress based on social expectations. It is essential to note that if users perceive the quality of the data generated by the CD app as unreliable or not representative of the general student population, it is likely to impact their trust in the value of the technology and subsequently reduce their uptake (Rodde, 2019;

Torous et al. 2018; Vankatesh & Davis, 2000). Thus, some participants felt the application's data could likely give users a false sense of reality.

The evidence agrees that self-reported data on mobile devices has an equivalent validity and reliability to traditional measures (Chakhssi et al., 2018; Chin & Leung, 2018; Weber et al., 2018). However, it was discovered that tracking multiple courses, integrating biometric and motion sensors, creating in-app event-driven notifications, and integrating the CD app into student workflows were essential to improving this self-reported data quality. In its pilot version, participants agree that the perceived stress ratings on the application reflect their stress experience, which concords with the moderate positive association found between their scores on the K10 scale (Kessler & Colpe, 2002) and the CD application's stress scale. Thus, there is feasibility for implementing the CD application to measure student perceived stress and time spent on assignments. However, several technical modifications and user behavioural considerations would need to be factored into improving the technology.

5.3.2. User Experience is Complex

Finally, the study provided evidence of the sophisticated nature of user experience and how it impacts the adoption of the CD innovation. As explained by the UTAUT, participants' user experience was connected to their willingness to use and recommend the CD app to their colleagues (Venkatesh et al., 2003). Specific key descriptors, including the simplicity of the user interface, ease of navigation, flexibility in controlling the application, and user-friendliness, were relevant to participants' experience with the technology. The CD app was also viewed as playful, which explains the increased engagement with it among participants (Venkatesh et al., 2003). However, the study found that making the CD app too playful or engaging could also result in an increased sense of burden and a negative perception of it as a distraction.

5.4. Field Reflections

As part of my reflexivity during the field work, I realized that my dialectical worldview enabled me to listen thoughtfully to different worldviews of participants on perceived stress and the CD app. With my academic training in Psychology, E-health, and Community and Population Health, I was also able to explore and understand students' perceived stress and technological interventions holistically. I was perceived by the participants as an insider due to

my student status, which helped build rapport and relate to participants' academic experience and perceived stress narratives. Similarly, my cultural values of social relationship building were primarily the key to building and maintaining a communicative social atmosphere during the interviews where participants felt safe to share their experience of perceived stress and academic workload.

Despite my background's advantages, my biases, presumptions, and experiences may have also influenced my research questions, how I conducted the interviews and how I interpreted and represented participants' experiences and voices. My student experience may have resulted in me taking specific experiences of perceived stress and curriculum workload for granted and failed to explore these experiences. Also, the narrative produced by this study, which may not necessarily be an authentic description of participants' truths, may be influenced by my personal biases as a student. To reduce the risk of my biases on the findings, I engaged in constant reflexivity on my privileges and biases throughout the entire research process. I also endeavoured to focus entirely on comprehending how the phenomenon appeared to participants and getting them to explain their lived experiences in their own words.

5.5. Limitations of the Study

The present study has several limitations. One crucial concern is the exclusion of instructors in the present study. Although several attempts were made to engage instructors in the study, the emergence of the COVID-19 pandemic and the subsequent transitions in teaching and learning reforms implemented at the University of Saskatchewan presented challenges in successfully including these instructors. Thus, their perspectives were missed in the study, which prevented an adequate exploration of the concepts of perceived stress and curriculum load within the teaching and learning process. It also affected the study's ability to understand instructors' views on the CD app's feasibility and acceptability.

Another weakness has to do with the accuracy of the K10 and the CD app's perceived stress rating scales. Like several other self-reported measures, participants may have under-or over reported their perceived stress for several reasons. For one, perceived stress is an indicator of mental health, a subjective experience and a sensitive topic; hence students may not be honest with their perceived stress reports. This could have resulted in a deflation of the actual point

estimates in this study. Likewise, perceived stress has multiple sources, and hence participants could have reported other stressors not necessarily linked to their curriculum-related work. Thus, it is difficult to distinguish between curriculum overload-related stress and other stressors faced by students daily. Furthermore, some participants raised concerns that reporting perceived stress could also be influenced by social desirability or reporting what they felt was expected of them. Moreover, the conceptualization of perceived stress based on self-reported ratings on the CD app may be an oversimplification of student's stress experiences. For instance, what aspects of the course assignments were perceived as stressful: density of task, the difficulty of task, or the duration of the task? Thus, some essential aspects of perceived stress may have been ignored, affecting the study's ability to explore students' lived experience of perceived stress comprehensively.

In addition, this study was conducted mainly on health sciences courses, which are predominantly professional programs. Thus, the speculation is that the objective of these professional training courses may often be to enforce regulatory compliance through inculcation of professionalism and clinical discipline into students, which could result in students being exposed to inherent challenging clinical training routines and lead to an increased sense of perceived stress among these students (Pruthi & Goel, 2014). Furthermore, the curriculum regimen and professional clinical training routines among these health sciences courses may not necessarily be homogenous, and thus the assumption is that the level of difficulty and intensity of perceived stress experienced by different health sciences students may vary significantly. For instance, research shows that the amount of academic work, simultaneous hand-in assignments and deadlines, frequency and duration of lectures, and imbalance in parallel course loads are a major challenge in the health sciences (Alsulami et al., 2018; Naidoo et al., 2014). However, these factors may vary across the different health sciences disciplines, especially, for medical students who tend to have more hectic schedules and time restraints (Altaf et al., 2013; Hill, Goicochea, & Merlo, 2018). Thus, the narrative on students' perceived stress produced by this study may not be representative of the entire spectrum of health sciences students, especially, among medical students who were not involved in this study. The implication is that the CD app could be a beneficial tool for curriculum developers in monitoring curriculum load to distribute it

appropriate within the different courses which could help reduce the intensity of curriculum-related perceived stress among these students.

Regarding the automatic task duration measure in the CD app, the timer was heavily dependent on participants' ability to remember and adequately record their time. Thus, a majority of participants had problems remembering to track their time when working on their assignments. Similarly, the conceptualization of curriculum overload was ambiguous as the study focused only on the duration of a course assignment. Other curriculum load parameters, including task difficulty and volume/density were not considered in the study. Thus, conceptualizing curriculum overload as assignment duration could have been affected by the students' task difficulty, the volume of assignment materials, and writing speed. Therefore, the study could have measured several aspects of curriculum workload but could not distinguish them due to how the term was conceptualized. The amount of time spent on an assignment is also confounded by several other factors, including a person's reading speed, undiagnosed reading disability, multitasking, distractions, and mental fatigue. All these limitations could have resulted in an under-or overestimation of the actual effects in the quantitative analysis.

A third limitation involves the potential for selection bias as a volunteer sample was used for this study. Only those students who were curious about the CD app or those overly stressed by their course-related tasks may have signed up for the study. Thus, this motivation effect could have biased any significant results away from the null.

Data privacy and fears of sanctions from instructors could have influenced students' participation in the study and reporting of perceived stress and time. Although students were assured that their instructors were not part of the research and would not have access to the data, recruiting them via academic courses they were enrolled in could have adversely affected their self-reports. For instance, they may not trust that their data was completely confidential and may have likely over-or underreported their perceived stress and curriculum load experience.

Lastly, other limitations of this study included the inability of this study to conduct an item-by-item analysis of the K10 scale to provide descriptive statistics of the percentages of response for each item. This was not done as it was considered to be beyond the scope of this

study. However, conducting this level of analysis would provide readers with further details on participant's responses on their stress experiences.

5.6. Recommendations

Considering the critical position occupied by instructors in the teaching and learning process, the CD app's implementation's success depends on them. Thus, there is a need to include instructors in future studies on the current topic to obtain a holistic perspective on the technology's feasibility and acceptability.

Also, ensuring the accuracy of the self-reported perceived stress data and automatically recorded task duration is critical to the feasibility and acceptability of the CD app. Thus, more objective measures, including the integration of wearable biometric sensor devices, could improve the quality of this data in future studies. Also, there is a need for future studies to focus on further validating the perceived stress scale in more extensive and diverse student populations. Future studies should also endeavour to re-examine and further fine-tune the conceptualization of perceived stress linked to curriculum overload to ascertain this lived experience comprehensively. To reduce the effects of social desirability and sensitivity of perceived stress, future studies must prioritize participants' confidentiality and provide demonstrable technical features in the CD app that give the participants the needed reassurance to help increase the accuracy of self-reported data. Lastly, stress has multiple sources. Thus, future studies need to adequately measure the various stressors students commonly experience in their daily lives to comprehensively distinguish curriculum-related perceived stress from the other forms of stress.

To increase the quality of the task duration data, there is also a need to introduce multiple time recording options in the app, including automatic motion sensors and allowing students to report their time data manually. Doing this will help ensure that the time reports are correctly measured. Besides, to reduce the memory dependency of the CD app's time recording feature, there is the need to introduce various event-related alerts that will consistently prompt students to track their time during different phases of their course assignments. There is a need further to refine the conceptualization of curriculum overload in future studies as this will influence the aspects of the phenomena that these studies will likely explore.

Selection bias and under or over-reporting of data due to concerns of data privacy could also be reduced by engaging a larger sample size recruited via probabilistic sampling techniques. Taking this approach will help to reduce the likelihood of motivation effects and social desirability. Also, participants should be correctly oriented on the CD app and provided the choice to share or withhold their data if they wish to do so. These implementations will help increase users' trust in their information security and lead to greater accuracy of the data reported.

Future studies should endeavour to include participants in the conceptualization, design, and development processes of the CD app. A majority of the study's findings indicate that user involvement in these phases could have resolved many of the limitations of the application that were discovered from the piloting exercise. In addition, interfacing the CD app with other sensor devices including wearing biosensor technologies will increase the number of stress-related variables that can be captured from users as well as increase the quality of the data gathered. There should also be an effort to gather more demographic data on users to allow for modeling of the different user personas and how the use and interact with the CD app.

5.7. Conclusion

This study explored the factors underlying the CD app's acceptability and feasibility for measuring curriculum load and perceived stress. By investigating these socio-technical concepts, the findings provide primary evidence on adoption of curriculum-related technology. This chapter synthesizes the various acceptability and feasibility findings of the study and discusses them in the context of post-secondary health sciences academic programs. The main takeaway is that the CD application is technically and contextually feasible to implement. Its development needs to prioritize demographic factors and positive user experience to gain acceptability within the general post-secondary health sciences student population. Some relevant acceptability considerations include the app's aesthetic appeal, variations in user demographics, data privacy, equity and unintended consequences of data, technical capacity building, and personal development. Regarding feasibility, nurturing a positive user experience and ensuring data authenticity were significant factors that need to be addressed. Other articulated contextual issues worth addressing to increase user uptake of the technology further included making it a low-cost solution and ensuring it is accessible to students of all backgrounds and circumstances. The

study's limitations were also presented, including the effects of selection bias, the accuracy of the self-reported perceived stress data and task duration records, the impact of privacy concerns, and exclusion of instructors from the present study. Some recommendations were also offered to future studies to help overcome some of these challenges, including involving instructors, implementing objective measures, providing participants alternative ways to measure their time, and reducing selection bias through probabilistic sampling with more extensive and diverse student populations.

Also, several critical questions are raised by this study that future researchers should contemplate. These questions surround several issues, including trust and fear of unintended consequences of tracking personal data, benefits versus risk of gathering sensitive classroom behavioural data, and the meaning of time for how long a student spends completing a given task. What factors influence how long it takes a student to complete a given task, and who does this reflect on, the student, instructor, or curriculum planner? Will the time reports potentially lead to victim-blaming? Will this data further increase inequity by creating unconscious biases? Will the use of the CD app further increase perceived stress among student users? Will the recorded time data lead to a false sense of reality among students and instructors? These were all critical feasibility and acceptability questions that emerged from the data and will ultimately impact the technology's adoption rate, and hence, require an in-depth investigation by future studies.

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APPENDIX A: KESSLER PSYCHOLOGICAL DISTRESS SCALE (K10)

This is a 10-item questionnaire intended to yield a global measure of distress based on questions about anxiety and depressive symptoms that a person has experienced in the most recent four week period.

The following questions concern how you have been feeling over the past 30 days. Tick a box below each question that best represents how you have been.

Please indicate how often each expression applies to you by filling in the number that best fits from 1='never' to 5='always'.

None of the time	*A little of the time*	*Some of the time*	*Most of the time*	*All of the time*
1	2	3	4	5

---

1. …….During the last 30 days, about how often did you feel tired out for no good reason?
2. …….During the last 30 days, about how often did you feel nervous?
3. …….During the last 30 days, about how often did you feel so nervous that nothing could calm you down?
4. …….During the last 30 days, about how often did you feel hopeless?
5. …….During the last 30 days, about how often did you feel restless or fidgety?
6. …….During the last 30 days, about how often did you feel so restless you could not sit still?
7. …….During the last 30 days, about how often did you feel depressed?
8. …….During the last 30 days, about how often did you feel that everything was an effort?
9. …….During the last 30 days, about how often did you feel so sad that nothing could cheer you up?
10. …….During the last 30 days, about how often did you feel worthless?

APPENDIX B: INDIVIDUAL INTERVIEWS GUIDE

App Engagement

1. What do you think about the application's ability to keep you engaged when using it?
2. What interests you the most about the CD App?
3. What would you say about the customizability of the application?
4. What were the most enjoyable aspects of using the CD App?
5. What kind of users do you think this app will be the best suited?
6. What features do you think could help improve the engagingness of this app to users?

App Functionality

1. How do you think the CD App performed in terms of its functionality?
2. What was your experience using the CD App (hard or easy to use)? Please explain.
3. What do you think about the navigation within the app (intuitive, complex, or lacking)?
4. What would you say are the weaknesses or challenges of using this app?
5. What would you prefer should be taken out or added to this app in the next revision

App Aesthetics

1. What do you think about the layout of the CD App?
2. How do you feel about the graphics in the app?
3. What would you say about the look and feel of the app?
4. What aesthetic components do you think are lacking or should be added to this app in the next revision?

App Informational Quality

1. Did the app meet your curricular needs (goal completion)? Please explain.
2. What do you think about the app's accuracy in measuring your time and level of stress information?
3. How do you feel about the quality of the feedback (time and stress tracking) given to you by the application?
4. How useful are the app's statistics on your time and stress tracking to you?
5. How do you feel about the credibility of this app (evidence-based)?

Subjective App Quality

1. What do you think about recommending this application to students of other courses?
2. Would you like to use this application again?
3. What is your overall impression (rating) of this app?
4. Did usage of this app add to your workload? Please explain.
5. Can you share what the usage of the app triggered in your mind?
6. What can be improved/added to the application?

APPENDIX C: DEMOGRAPHICS QUESTIONNAIRE

Please respond to the items below:

This survey is to determine your experience of curricular workload and associated stress. Please note that all information provided will be maintained confidential and will be collated and analyzed by Mr. Jeremiah Acharibasam and Dr. Kalyani Premkumar, who are not directly involved in this course. As such, your responses will have no bearing on your course grades. The aggregate data may be used in conference presentations and future publications relating to teaching effectiveness and learning. The full survey should typically take you 15-30 minutes of your time.

Jeremiah Acharibasam and Dr. Kalyani Premkumar

1. NSID…….
2. First Name……
3. Last Name……
4. Gender ☐ Male ☐ Female ☐ Other (please state)……
5. Your age ☐ 16+ - 20 ☐ 21+ - 26 ☐ 27+ -30 ☐ 31+ - 36 ☐ 37+
6. What is your declared or proposed major? …….
7. What is your year of post-secondary study?
8. 2nd year ☐
9. 3rd year ☐
10. 4th year ☐
11. Other (please explain)……..
12. What is your college/department?.....

Individual interviews

The individual interview session (about 15 to 20-minutes duration) will be held at the end of the piloting of the Curriculum Densitometer application to get the views of participants on the feasibility of the Curriculum Densitometer application.

Are you willing to participate in the Individual interviews? Yes ☐ No ☐

If yes, please click on this link: https://www.surveymonkey.ca/r/CDappfocusgroups

Or you can also scan this .R.Q.R.  Code:

APPENDIX D: ETHICS APPROVAL

UNIVERSITY OF SASKATCHEWAN

Behavioural Research Ethics Board (Beh-REB) 27-Sep-2020

Certificate of Re-Approval

Application ID: 1457

Principal Investigator: Kalyani Premkumar

Department: Department of Community Health and Epidemiology

Locations Where Research Activities are Conducted: University of Saskatchewan, Canada
University of Saskatchewan Health Sciences Building, Canada
Saskatoon, Prince Albert, and Regina Campuses, Canada

Student(s): Jeremiah Acharibasam

Funder(s):

Sponsor:

Title: Impact of Curriculum Overload on Students Mental Health Using the Curricular Densitometer

Approved On: 14/10/2020

Expiry Date: 14/10/2021

Acknowledgment Of: None

IRB Registration Number: Not Applicable

* This study, inclusive of all previously approved documents, has been re-approved until the expiry date noted above

CERTIFICATION

The University of Saskatchewan Behavioural Research Ethics Board (Beh-REB) is constituted and operates in accordance with the current version of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2 2014). ˙The University of Saskatchewan Behavioural Research Ethics Board has reviewed the above-named project. The proposal was found to be acceptable on ethical grounds. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this project, and for ensuring that the authorized project is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol or consent process or documents.

ONGOING REVIEW REQUIREMENTS

In order to receive annual renewal, a status report must be submitted to the REB Chair for Board consideration within one month prior to the current expiry date each year the project remains open, and upon project completion. Please refer to the following website for further instructions: https://vpresearch.usask.ca/researchers/forms.php.

Chair, Behavioural Research Ethics Board
University of Saskatchewan

APPENDIX E: OPERATIONAL ETHICS APPROVAL

UNIVERSITY OF SASKATCHEWAN
College of Nursing
NURSING.USASK.CA

College of Nursing
Health Sciences Building A-Wing 1A10
107 Wiggins Road, Saskatoon, Saskatchewan S7N 5E5
Telephone: (306) 966-6221 Facsimile: (306) 966-6621

April 20, 2020

Mr. Jeremiah Acharibasam
Department of Community Health and Epidemiology
University of Saskatchewan

Dear Mr. Acharibasam,

RE: Using the Curriculum Densitometer to Measure the Impact of Curricular Workload on Students' Mental Health: A Pilot Study

Thank you for sending the above research proposal and ethics certificate for consideration of operational approval with the College of Nursing. I am pleased to inform you that your study has been operationally approved.

Please note, this approval does not extend to health science students from any other College, Unit, or Department. Contacting College of Nursing students will be done through the College of Nursing and, therefore, please email all recruitment materials to Raeleen Wilson at raeleen.wilson@usask.ca when they are ready.

We wish you well in this study and would kindly ask that you share a copy of your report with us as we are very interested in hearing about the results.

Please feel free to contact me if you have any questions or concerns.

Sincerely,

Associate Dean Research, Innovation and Global Initiatives
College of Nursing