Optimizing Mental Health for Student Success at University:

A Case for Self-Regulated Learning

by

Sarah K. Davis

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We acknowledge with respect the Lekwungen peoples on whose traditional territory the university stands and the Songhees, Esquimalt and W̱SÁNEĆ peoples whose historical relationships with the land continue to this day.

Supervisory Committee

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Sarah K. Davis

Supervisory Committee

Allyson F. Hadwin, Department of Educational Psychology & Leadership Studies
Supervisor

Todd M. Milford, Department of Curriculum & Instruction
Outside Member

Catherine L. Costigan, Department of Psychology
Outside Member

Abstract

Mental health is one of the biggest issues facing governments around the globe (Keyes, 2013). Mental health is a state of well-being wherein individuals realize their potential, cope with normal life stressors, work productively, and contribute to society (World Health Organization, 2014). Findings from the American College Health Assessment survey reveal the vast majority of postsecondary students in Canada and the United States report (a) feeling inundated and exhausted by their academic work, and (b) experiencing levels of stress and anxiety compromising physical and mental health, academic learning, and personal success (ACHA, 2019). Self-regulated learning (SRL) is a key component of student success at university, however despite the large body of research establishing the role of SRL in student success at university, there is a paucity of research on mental health and SRL at university. To date mental health and SRL have been underexamined as dynamic processes that develop over time as highly situated, metacognitive processes. The purpose of this multi-paper dissertation was twofold: (a) to examine the interplay between self-regulated learning and mental health in student success at university, and (b) to explore a variety of methods and analyses examining this interplay. Davis and Hadwin (2019) examined psychological well-being (PWB) and SRL and how they differ between groups of students with different levels of within-person PWB during an academic semester of a learning-to-learn course. Davis, Milford, and MacDonald (2019) used multi-level modelling to further examine the associations over time between students' PWB and academic engagement, goal attainment, goal satisfaction, and rating of mental health and well-being challenge. Finally, Davis, Rostampour, Hadwin, and Rush (2020) built on the findings of Papers 1 and 2 by using a case study approach to examine mental health and adaptive regulation exhibited by two contrasting groups of students (i.e., the high mental health group and the low

mental health group) in a university learning-to-learn course. There were five main findings from the studies in this dissertation. First, there is a positive relation between PWB and SRL. Second, mental health is a condition and product affecting learning. Third, students' mental health affects metacognitive standards and is a target of learning goals. Fourth, students' mental health affects their engagement in adaptive regulation of learning. Fifth, including mental health in online SRL diary tools may benefit all students. Finally, the main findings from this dissertation provide two directions for future research: (a) considering the interplay of mental health SRL as a heuristic process fueled by metacognition where students take an active role, experiment, and consider feedback in their learning, and (b) situating mental health within metacognitive SRL interventions.

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List of Original Manuscripts

This dissertation comprises three manuscripts as referenced below by author and year:

1. Davis, S. K. & Hadwin, A. F. (2019). Exploring differences in psychological well-being and self-regulated learning in university student success. *Manuscript in submission.*
2. Davis, S. K., Milford, T. M., & MacDonald, S. W. S. (2019). Examining associations over time between psychological well-being, academic engagement, and goal attainment. *Manuscript in submission.*
3. Davis, S. K., Rostampour, R., Hadwin, A. F., & Rush, J. (2020). The role of mental health in adaptive regulation of learning and student success. *Manuscript in preparation.*

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Dedication

This dissertation is dedicated to all the students
I had the privilege of meeting during my time
working in secondary schools as
a teacher and school counsellor
from 2003-2015.

Your resilience and successes
in the face of adversity
were the inspiration for this work.
Thank you for teaching me
more than you will ever know.

Chapter 1: Theoretical Framework

Mental health is one of the biggest issues facing governments around the globe (Keyes, 2013). Worldwide, the direct and indirect costs of mental health conditions are estimated to be 2.5 trillion USD annually with this amount expected to almost triple to 6 trillion USD by 2030 (Bloom et al., 2011). The huge burden of mental illness takes a toll on individuals, their families, society, and health systems (Hewlett & Moran, 2014). Policy to address mental health concerns needs to be multi-disciplinary and coordinated across the sectors of education, health, and labour markets (OECD, 2012). Prevention of mental illness is vital, because individuals with mental illnesses are less likely to complete school, get a full-time job, have a well-paid career, and live a good quality life (Doran & Kinchin, 2017). Targeting prevention efforts on youth is crucial as 50% of mental disorders appear by the age of 14, and 75% of mental disorders appear by the age of 24. Enrollment in postsecondary education by 18-24 year olds globally has risen consistently since 1970 (World Bank, 2010), and more students are attending university and self-reporting mental health issues than ever before. Increased attention on student mental health has resulted in more media outlets around the world writing about the perceived "mental health crisis" on university campuses (e.g., Chiose, 2016; Henriques, 2018; Wakeford, 2017).

Previous research has examined the role of mental health at university, most often through large, nationwide surveys. Findings from the American College Health Assessment survey reveal the vast majority of postsecondary students in Canada and the United States report (a) feeling inundated and exhausted by their academic work, and (b) experiencing levels of stress and anxiety compromising physical and mental health, academic learning, and personal success (ACHA, 2016, 2018). In the United Kingdom, 78% of postsecondary students reported experiencing problems with their mental health in the past year (National Union of Students, 2015). The consequences of poor mental health on postsecondary students are clear: mental health concerns are a common reason given by university students who take a temporary leave of absence or drop out altogether (Svanum

& Zody, 2001; Yorke & Longden, 2007). Preventing this attrition is challenging because unfortunately, few students experiencing mental health challenges seek help (ACHA, 2016, 2018; Leitch, 2007). To address both the rising mental health concerns and the knowledge that students rarely seek help, more universities are implementing mental health promotion or mental health literacy programs. Mental health promotion programs in higher education often focus on psychoeducation, meditation, mindfulness, relaxation, or social skills (Conley et al., 2015). However, these programs operate largely in out-of-classroom settings, ignoring the role of mental health in academic success.

Self-regulated learning (SRL) is a key component of student success at university. Successful students self-regulate their learning by exercising strategic control over their behaviour, motivation, emotion, cognition, and metacognition to reach goals (Pintrich, 2004; Schunk & Greene, 2018; Winne & Hadwin, 1998; Zimmerman, 1989, 2000). These SRL processes can act as mediators between personal and/or contextual characteristics and achievement, performance, or outcomes (Pintrich, 2004). Learners who self-regulate succeed academically because they can draw from a wide repertoire of strategies to successfully navigate challenges arising during day-to-day tasks and activities (Hadwin et al., 2011, 2018; Hadwin & Winne, 2012).

Despite the large body of research establishing the role of SRL in student success at university, there is a paucity of research on mental health and SRL at university. The limited research on mental health and SRL to date (e.g., Grunschel et al., 2016; Howell, 2009) has measured SRL and mental health at one time point, ignoring their dynamic natures and fluctuations. There is a lack of research examining how SRL strategies and processes co-emerge with perceptions of mental health during an academic semester while students navigate coursework, adjustment to university life, and challenges to student success. Therefore, the purpose of this dissertation is to examine the interplay between self-regulated learning and mental health in student success at university.

Defining Mental Health

Mental health is a state of well-being wherein individuals realize their potential, cope with normal life stressors, work productively, and contribute to society (World Health Organization, 2014). This definition reflects a movement in psychology after World War II toward not only identifying and diagnosing mental illness, but also promoting mental health (see Keyes, 2013). Post World War II, prevention of mental illness focused on promoting growth, well-being, and wellness, but these three areas were less of a priority than categorizing and treating mental disorders (Keyes, 2013; Ryan & Deci, 2001). Mental health research originated in the 1990s with the emergence of the field of positive psychology (Keyes & Haidt, 2003). This new field focused on "the scientific study of what makes life most worth living" (Peterson, 2008, para. 4). Divergent theories and models examine well-being and mental health, however due to inconsistencies in this growing body of research, terms such as well-being, mental health, mental illness, and mental disorder, are frequently conflated. Thus, clearly defining mental health is crucial for theoretically framing and advancing research in this area.

Mental Illness

This dissertation is focused on mental health, however defining mental illness helps further clarify the differences between mental health and mental illness. Mental illness is a separate, yet related construct to mental health (Keyes, 2003, 2005) and refers to assessing mental disorders categorically and/or dimensionally. The main tool used by professionals in the diagnosis, prognosis, etiology, and treatment of mental illness is the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; APA, 2013). The DSM-5 defines a mental disorder as "a syndrome characterized by clinically significant disturbance in an individual's cognition, emotion regulation, or behavior reflecting a dysfunction in the psychological, biological, or developmental processes underlying mental functioning" (APA, 2013, p. 12). Examples of mental disorders include mood disorders and anxiety disorders.

Distinguishing further between mental health and mental illness is beyond the scope of this dissertation and has been written about in detail elsewhere (e.g., Keyes, 2003). The World Health Organization (2014) estimates one in four people in the world will be affected by a mental disorder during their lifetime, whereas 100% of the world's population has mental health, the topic of this dissertation. One benefit of focusing on mental health is because "bringing about well-being—positive emotion, engagement, purpose, positive relationships, and positive accomplishment—may be one of our best weapons against mental disorder" (Seligman, 2008, p. 5). Thus, research on mental health has the potential to significantly contribute to quality of life and overall health.

Keyes' (2005) Dual-Continua Model of Mental Health

Since the 1990s, the field of positive psychology has focused on how mental health can be developed and nurtured (Keyes & Haidt, 2003; Seligman, 2003). One of the leading mental health theories in use today is Keyes' (2002, 2005) dual-continua model. The dual-continua model emphasizes mental illness and mental health do not exist as opposite ends of a single continuum, but rather as distinct, correlated axes indicating mental health is a separate state (see Figure 1; Keyes, 2005, 2013). Keyes (2002) operationalizes mental health as individuals' subjective well-being, or in other words, how individuals perceive and evaluate their own affective states, psychological functioning, and social functioning. This model includes both hedonic (i.e., positive feeling) and eudaimonic (i.e., positive functioning) perspectives, which are important for understanding the full scope of human well-being (Deci & Ryan, 2008; Henderson & Knight, 2012; Huta & Ryan, 2010). Other well-being models include aspects of hedonia (e.g., subjective well-being, Diener, 1984), and/or eudaimonia (e.g., psychological well-being, Ryff, 1989; self-determination theory, Ryan & Deci, 2000) in their theories. However, Keyes' model expands beyond these other conceptualizations of mental health to include social well-being as a separate factor.

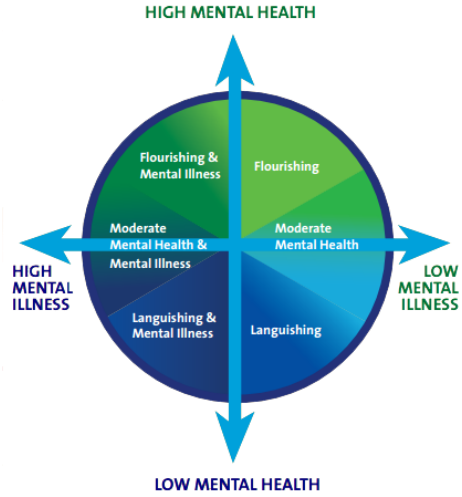

Figure 1. Keyes' dual-continua model of mental health. Figure from "Promoting and protecting positive mental health: Early, and often throughout the lifespan," by C. L. M. Keyes in C. L. M. Keyes (Ed.), *Mental well-being: International contributions to the study of positive mental health* (p. 17), 2013, Netherlands: Springer. Copyright 2013 by C. L. M. Keyes. Reprinted with permission.

The dual-continua model originated from research examining the relationship between the three mental health factors (i.e., psychological, social, and emotional well-being) and mental illness (Keyes, 2005). Research findings indicated the best model fit situates mental health and mental illness as separate, correlated axes (Keyes, 2005). Individuals can have flourishing, moderate, or languishing mental health depending on their symptoms of mental health. Symptoms of positive functioning and positive feelings are measured through Keyes' (2009) 14 item self-report Mental Health Continuum-Short Form (MHC-SF). The MHC-SF asks individuals to indicate how many times in the past month they have experienced the symptoms of emotional, psychological, and social well-being. Individuals with flourishing mental health (a) experience positive emotions toward life, (b) function well both psychologically and socially, (c) have excellent emotional health, (d) miss few days of work or school, and (e) do not have physical limitations in their daily lives (Keyes, 2003). Individuals with languishing mental health (a) experience a lack of positive emotions, (b) do not function well psychologically or socially, (c) have not been diagnosed with depression in the past year, and (d) experience emotional distress at the levels of a major depressive

episode (Keyes, 2003). Individuals who do not fit either of the preceding criteria for flourishing or languishing are moderately mentally healthy.

The Three Factors of Mental Health

Mental health comprises three factors: emotional well-being (i.e., positive feeling or hedonia), and social well-being and psychological well-being (i.e., positive functioning or eudaimonia; Keyes, 2002, 2005). Keyes' theory emerged from research on subjective well-being defining well-being as life satisfaction and happiness (Keyes et al., 2002), and from recognizing mental health is not solely a private phenomenon but is also a social phenomenon (Keyes, 1998). Therefore, social context is integral to individuals' mental health and defining mental health in general. The dual-continua model emphasizes the importance of positive functioning (i.e., psychological and social well-being) and positive feelings (i.e., emotional well-being) in overall mental health (see Table 1).

Table 1

Summary of three factors in Keyes' dual-continua model

Psychological well-being	Social well-being	Emotional well-being
Self-acceptance: Positive attitude toward oneself and accepts past versions of self	*Social integration:* Feels part of a community	*Positive affect:* Cheerful, in good spirits, calm/peaceful, satisfied, full of life
Positive relations with others: Trusts others, capable of empathy	*Social contribution:* Feels useful to society and makes valued contributions	*Avowed quality of life:* Sense of contentment/satisfaction with past/present life overall
Autonomy: Has internal standards, resists negative pressures	*Social coherence*: Interested in society and feels it is meaningful	
Environmental mastery: Manages complex environments, can choose or create suitable environment	*Social actualization:* Cares and believes people/society can evolve positively	
Life purpose: Has goals and beliefs, feels life has purpose or meaning	*Social acceptance:* Positive attitude toward other, accepts others' complexity	
Personal growth: Reflects on how one is developing, open to challenging experiences		

Psychological Well-Being. Psychological well-being refers to how individuals perceive the quality of their functioning in life (Keyes, 2013). Originally derived from developmental, personality, and clinical psychology research (see Ryff & Keyes, 1995), psychological well-being includes six psychological dimensions influencing how individuals navigate challenges in their personal lives (Keyes, 2013). The first dimension, s*elf-acceptance*, refers to how individuals assess themselves by accepting good and bad qualities from their past (Ryff & Keyes, 1995). *Positive relations with others* refers to developing warm, trusting relationships through empathy, cooperation, and compromise (Keyes, 2013). *Autonomy* refers to self-determination and independence evidenced by resisting social pressures, self-regulating behaviour, and self-evaluation (Ryff & Keyes, 1995). *Environmental mastery* refers to a propensity to structure the environment

by controlling complex external activities and creating suitable contexts to capitalize on opportunities. *Purpose in life* highlights individual life goals and direction, derives meaning from past and present lives, and believes life has purpose and meaning. Finally, *personal growth* represents continued development and growth as an individual, openness to new experiences, and self-improvement via change reflecting more self-knowledge (Ryff & Keyes, 1995).

Social Well-Being. Social well-being represents the public experience of individuals who encounter social situations in their communities (Keyes, 2013). Humans are social beings; therefore, the social nature of human life warrants the inclusion of social well-being into understanding mental health (Keyes, 1998). Social challenges, in particular, may be criteria individuals use to assess the quality of their lives, for example through relationships and interactions with others. There are six dimensions of social well-being representing how individuals perceive their social functioning (see Keyes, 1998). The first dimension, *social integration*, represents how individuals evaluate the quality of their relationships, whether they feel they belong, and whether they have commonalities to society as a whole and within their communities (Keyes, 2013). *Social contribution* represents individuals' evaluations of their contributions to society and whether they are of value or not. The next dimension, *social coherence*, is concerned with the quality, organization, and operation of society and whether the world makes sense as it is currently organized. *Social actualization* is the belief that despite continuous changes, society has potential to be self-realized, or self-determined, through its citizens and institutions. Finally, *social acceptance* indicates when individuals operate in the public sphere largely consisting of strangers, these individuals trust others, believe others are kind, and think others can contribute to society (Keyes, 1998).

Emotional Well-Being. Positive feeling is operationalized as hedonic well-being, or emotional well-being. Emotional well-being captures feelings of overall happiness and satisfaction with life through balancing positive and negative affect (Keyes, 2013). There are two dimensions to emotional well-being: positive affect and avowed quality of life (Keyes, 2007). *Positive affect*

indicates whether individuals are regularly cheerful, interested in life, happy, calm, peaceful, and full of life. *Avowed quality of life* captures level of satisfaction with overall life or in life domains. Rather than focusing on situational emotions, emotional well-being assesses individuals' overall ratings of their larger-grained emotional states. For example, individuals judge their overall daily or weekly emotional well-being rather than the frequency or valence of specific positive or negative emotions, such as anger, frustration, or excitement.

Prevalence Rates of Mental Health

Keyes' (2002, 2005) conceptualization of mental health as a continuum has been adopted and empirically validated worldwide (see Keyes, 2013), across developmental age groups (e.g., Howell, 2009; Peter et al., 2011; Suldo and Shaffer, 2008), and in diverse cultural contexts (e.g., Joshanloo et al., 2013). Many studies, such as these, examine the prevalence rates of flourishing, moderate, and languishing mental health. In a sample of 3,000 adults aged 25-64 in the United States, 86% of adults reported no major depressive episode and 14% reported a major depressive episode in the past year (Keyes, 2002). Of the adults who reported no depressive episode, 17% were flourishing, 57% had moderate mental health, and 12% were languishing. Further, of the 12% who were languishing, none of these adults reported any symptoms of depression. Findings may indicate that languishing mental health is a risk factor for developing depression even before symptoms of depression are present. Or, perhaps the absence of a mental illness does not imply the presence of mental health as those adults who were languishing did not have depression (Keyes, 2013). In a study with adolescents, Keyes (2006) found higher prevalence rates of flourishing, whereas Peter et al.'s (2011) study found rates of flourishing decreased between the adult and adolescent samples. Despite the limitations of cross-sectional sampling from different populations, trends across these studies evidence declines in mental health from adolescence to adulthood (see Table 2).

Table 2

Comparing mental health prevalence rates across developmental stages

Population Sampled	Flourishing mental health	Moderate mental health	Languishing mental health
1234 USA youth 12-18 (Keyes, 2006)	38%	56%	6%
1200 Canadian university students ages 17-24 (Peter et al., 2011)	24%	67%	9%
3000 USA adults ages 25-64* (Keyes, 2002)	20%	66%	14%

*Note: *these percentages are based on the 84% of adults in this study who did not have depressive symptoms (17% flourishing, 57% moderate, 12% languishing). In order to compare these numbers to the other studies, these percentages were transformed to total 100%.*

Promotion and Prevention Efforts

Promoting mental health may reduce the incidence and prevalence rates of mental illness (Keyes, 2013). Untreated or undiagnosed mental illness has long-lasting consequences; individuals with mental illnesses are less likely to complete school, secure full-time employment, or obtain well-paid careers (Doran & Kinchin, 2017). Sustained languishing mental health may put adults at risk of developing a mental illness; adults with languishing mental health have been found to be six times more likely to develop a mental illness after 10 years compared to those with moderate or flourishing mental health (Keyes et al., 2010). The serious implications and prevalence rates of languishing mental health reveal the importance of proactive interventions targeted at the developmental ages when flourishing mental health begins to wane. Postsecondary students represent an important target audience for such interventions because university students (a) are in the age range of 18-25 where 75% of mental disorders appear (OECD, 2012), (b) experience stress and anxiety compromising their academic learning and success (ACHA, 2016, 2018), and (c) report lower levels of flourishing mental health than secondary school students (Peter et al., 2011). Thus, understanding the role of mental health at university is vital for optimizing student success.

Student Success at University

Student success research has moved toward a multidimensional view of student success. This view has move from a larger grained definition at the institutional level (e.g., Kuh et al., 2007) to smaller grained definitions at the student level. Van der Zanden et al. (2018) define student success in the first year of university as comprising three domains at the student level: critical thinking, academic achievement, and socio-emotional well-being. Their definition of student success recognizes (a) the complexity of student success particularly in the first year requires a multidimensional focus, and (b) many of the predictors of success overlap between these domains suggesting they are not independent of each other. For example, students with higher previous academic achievement, learning and study skills, intrinsic motivation, and stronger relationships with parents and peers have higher academic achievement, critical thinking skills, and/or social-emotional well-being. Further, findings from this meta-analysis suggest some students' success in one domain may influence success in another, or some students may experience problems in one domain at the cost of another (van der Zanden et al., 2018).

As a self-regulated learning researcher, I adopt an even finer-grained definition of student success as attaining self-set goals (e.g., academic, social) to self-determined standards of excellence by exercising strategic metacognitive monitoring and control of behaviours, emotions, motivation, and cognition within and across study sessions. Self-regulated learning theory acknowledges goals are multifaceted even within single study sessions. Goals often include standards and attributes associated with larger-grained aspects, such as general student satisfaction and sense of belonging to an institution, increased critical thinking, scientific literacy, quantitative and writing skills, personal functioning through self-awareness, confidence, sense of purpose, and self-worth (Kuh et al., 2007). Finer-grained academic goals are no different in that respect as goals involve a balancing of these attributes and standards to maximize progress in ways that are valued by the individual learner. Ultimately, student success is about optimizing students' autonomy and progress toward personal and academic goals.

Self-Regulated Learning for Student Success

Self-regulating learning (SRL) is the foundation for student success. Self-regulating learners take control of their own learning, motivation, affect, and behaviors while striving to attain their own learning goals (Schunk & Greene, 2018; Zimmerman, 1986; 1990; Zimmerman & Schunk, 1989). The vast amount of information and choices in university can easily become overwhelming, and students need to be active participants in their learning rather than passive recipients of information (Pintrich, 2004). Self-regulation can help students organize their thoughts, feelings, and actions to attain their academic and personal goals (Usher & Schunk, 2018). This is because SRL is both a model of (a) what students do in real-life learning situations, and (b) how students can optimize their learning (Efklides et al., 2018).

There are three main components of SRL: metacognition, strategic action, and motivation (Winne & Perry, 2000; Wolters, 2003; Zimmerman, 1990). Flavell (1976) defined metacognition as the active monitoring, regulation, and coordination of cognitive processes and products to attain goals. These cognitive processes are situated in three categories of person, task, and strategy (Flavell, 1979). This definition of metacognition has expanded to include non-cognitive processes as well, including motivation, behaviour, and emotions. In SRL, metacognition is (a) the awareness students demonstrate about their academic strengths and weaknesses (Winne & Perry, 2000), and (b) is influenced by and influences motivation and emotions (Winne, 2018). For example, learners must interact with people, the task, and strategies during learning situations, through metacognitively monitoring and evaluating their strengths and weaknesses, considering task features, and selecting strategies to address and overcome challenges (Perry & Rahim, 2011).

Strategic action (a) is guided by this metacognitive awareness of situations, tasks, challenges, and (b) allows learners to optimize information acquisition, expertise and proficiency, and self-improvement (Perry & Rahim, 2011). Strategic action is socially situated: students learn in social environments, thus being exposed to effective models of self-regulating learning can help

students identify better strategies for planning, monitoring, and attaining their goals (Usher & Schunk, 2018).

Motivation guides learners' actions by directing their attention, affecting their choices, and increasing the effort needed to overcome challenges and attain goals (Usher & Schunk, 2018). When students regulate their motivation, they purposefully and proactively start, continue, and complete the work needed to attain goals (Wolters, 2003). In sum, students' can be metacognitive about their behaviour, cognition, motivation, affect, and/or socioemotional experiences due to learning and attaining academic goals being a situated, dynamic process.

Metacognitive Knowledge and Experiences

Mental health and SRL are both multi-dimensional processes optimized by self-awareness during learning. This includes monitoring information from both metacognitive knowledge and metacognitive experiences during learning. Metacognitive knowledge includes individuals' knowledge or beliefs about the interactions between person, task, and strategy, and how these factors affect cognition (Flavell, 1979). Metacognitive experiences are individuals' beliefs and/or feelings about their cognitive progress toward goals/tasks. Mental health is a subjective experience encapsulating psychological, emotional, and social well-being, and may be a particularly important piece of metacognitive knowledge, especially for university students, as they adjust to a new environment.

Flavell's (1979) model of metacognition highlights the overlap between metacognitive knowledge and experience. This is because during learning, students (a) establish goals that may result in revisions to their metacognitive knowledge, and (b) activate strategies to attain these goals (Flavell, 1979). Metacognitive experiences may be heightened specifically during learning challenges, where students' metacognitive knowledge about their thoughts and feelings has potential to help them navigate these new situations. During academic challenges, individuals may experience new thoughts and feelings and rely on metacognitive knowledge on how to proceed. This conscious process of awareness of metacognitive knowledge (i.e., beliefs and/or knowledge

about a person, task, and strategy previously encountered) describes where knowledge and experience interact.

An example of the interactions between metacognitive experience and knowledge can be evidenced in a situation where a student sets a goal to get an A on a math exam. This student determines this is a challenging goal due to the fact the student is currently failing the course and the student feels their mental health is at risk due to the stress of this course. The student uses the strategy of seeking help from the course instructor, who shares strategies with the student about studying for the exam. After receiving this help, the student considers whether the help is contributing to the original goal of getting an A on the exam, realizes the original goal needs to be revised, and sets a new goal focusing on learning material from the course instead. By taking control of their learning, the student's mental health may improve. This goal revision relies on comparing metacognitive experiences to knowledge. This cycle could take place multiple times during learning (Flavell, 1979). Each part of this metacognitive cycle requires shifting, both consciously and unconsciously, from beliefs the student holds about existing knowledge to the new experiences in attaining a goal. Therefore, conceptualizing SRL through a model highlighting the role of metacognition in regulating learning is crucial to examine the interplay between SRL and mental health.

Models of SRL

SRL models seek to explain how individuals actively, purposefully, and reflectively control or optimize their own functioning and/or behaviour (Wolters, 2010). Most SRL models contain considerations of planning, performance, and reflection (Pintrich, 2004; Zimmerman, 2000), and many models highlight the roles of metacognition, cognition, motivation, and emotion (see Panadero, 2017). Mental health, as defined by Keyes (2002), has not been addressed in any SRL models. Boekaerts' (2006) SRL model is the first model to explicitly incorporate mention of well-being but the type of well-being in the model is not clearly defined. In Boekaerts and Corno (2005),

well-being in the model is elaborated on as emotional well-being, however no definition is provided. This model proposes two self-regulatory pathways during learning including the mastery/learning pathway and the coping/well-being pathway. Students who aim to attain a goal choose the mastery/learning pathway, whereas students who are concerned with their well-being choose the coping/well-being pathway (Boekaerts & Cascallar, 2006). Students may switch back and forth between these two pathways by using motivation regulation strategies. A limitation of the Boekaerts model is that it seems to place coping/well-being on a competing plane with mastery learning thereby implying that students must choose between maximizing well-being and mastery learning.

In Boekaerts' (2006) model, the separation of well-being (i.e., mental health) from mastery learning stands in opposition to Keyes' (2005) conceptualization that mental health is omnipresent. For example, when students face academic challenges during learning, their mental health has the potential to always be a factor in their success. What is unknown, however, is how students' mental health influences their engagement with SRL or how engaging in SRL processes influences mental health. Identifying mental health as a process with the potential to affect how students self-regulate their learning—or vice versa—could be situated in any SRL model recognizing the myriad processes affecting students' learning. Most SRL models highlight the importance of goal-setting and planning in SRL. Therefore, the SRL model should consider all students' goals and the resulting challenges as potential places to raise metacognitive awareness of students' self-regulatory strategies and processes, including their mental health.

Winne and Hadwin's (1998) 4 Phase Model of SRL

Winne and Hadwin (1998; see Figure 2) model SRL over four loosely sequenced, recursive macro-level phases with metacognition highlighted as occurring throughout all four phases. The first phase is task perceptions. As many students struggle to understand the task(s) given to them, this phase focuses on students' task perceptions, and prompts them to think about the explicit (e.g., task criteria), implicit (e.g., task purpose), and sociocontextual (e.g., discipline-specific features) information of the task (Hadwin & Winne, 2012). Understanding academic tasks has proven to pose challenging for students across tasks and contexts (Greene et al., 2012; Hadwin et al., 2007; Miller, 2009, 2015) because students need to interpret task descriptions and criteria as

well as make inferences about academic work with respect to broader course content, goals, and values.

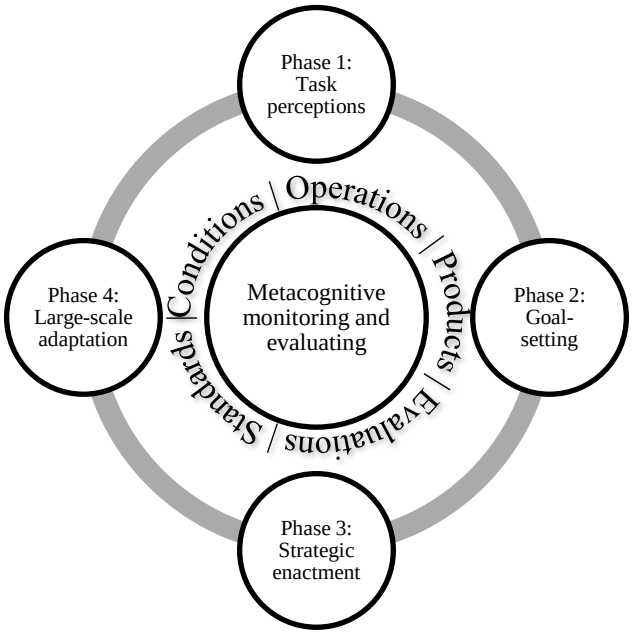

Figure 2. Winne and Hadwin's (1998) 4 phase SRL model

Goal-setting, the second phase, is most effective when task understanding is clear and the goal targets the learning process, not the product. For example, a student studying for a biology exam would ideally set a goal to master certain topics and set standards for when they know they have reached this goal, rather than to just study without purpose for the exam for two hours. The third phase is strategic enactment, and this is what students usually consider as studying (Hadwin & Winne, 2012). However, without accurate task understanding and specific goals, this phase is often stalled and may result in ineffective or inaccurate strategy selection. Effective strategies take into consideration the expectations of the task and the standards of the set goal(s). The fourth phase, large-scale adaptation, is optional and comprises the reflective component of SRL, where students troubleshoot after reflecting on the problems they experienced during studying (Hadwin & Winne, 2012).

When learners generate metacognitive knowledge about their studying approaches and combine it with past metacognitive experiences, they are setting the stage for identifying maladaptive patterns and making adaptations as needed. This emphasis on metacognition in adaptation in SRL highlights the centre of this four-phase model—metacognitive monitoring and

evaluating occurring during and throughout every phase. Metacognition involves thinking, specifically thinking about the quality of information either given or received by cognitions (Winne, 2018), behaviour, emotions, and/or motivation. Winne and Hadwin (1998) further describe metacognitive monitoring as a cognitive operation comprising (a) an object-level attribute around a product of studying (e.g., reviewing definitions of key terms for a biology test), (b) a meta-level attribute providing standards for that product (e.g., how much effort to use, when the key term has been memorized), and (c) a product that records discrepancies between the object- and meta-level information (e.g., the student realizes they need to make connections between the terms for the test, not just memorize them). From an SRL point of view, students monitor and evaluate their cognition, behaviour, motivation, and/or emotion during each phase of SRL.

COPES Architecture. Each phase of this model also contains the cognitive architecture of conditions, operations, products, evaluations, and standards (Winne, 1997). The COPES architecture describes the interactions at the micro-level that occur within and across the macro-level phases (i.e., task perceptions, goal-setting, task enactment, and large-scale adaptation) of SRL. The *conditions* of a task capture the broad environmental factors and cognitive information within which cognitions occur (Winne & Hadwin, 1998). These conditions can be internal or external about the task or oneself; the conditions occurring during phase one (i.e., task perceptions) have the potential to carry over to other phases through the products created in phase one and subsequent phases. The cognitive processes, tactics, and strategies students use in doing or planning for a task are the *operations* (Winne & Hadwin, 1998, p. 280). These operations include the cognitive operations of searching, monitoring, assembling, rehearsing, and/or translating. Operations can also result in external behaviours for others to observe about the student.

The information or new knowledge created by the operations engaged are the *products* (Winne & Hadwin, 1998). These products are directly informed by students' task perceptions and affect planning and strategy choice to enact the task. Products are internal and external; in addition, products represent a range of attributes beyond cognition (e.g., motivation). The feedback students

receive about their products can be generated externally or internally and comprise *evaluations* (Winne & Hadwin, 1998). These evaluations are internal but can be informed by external evaluations; ultimately, the interpretations by the learner are what fuel this action, both in the present and the future. Metacognitive judgments are central to evaluations; *evaluations* are judged against criteria and then compared to standards (Winne & Hadwin, 1998). For example, students must compare their products to the established standards and how close their products fit those attributes. Standards provide criteria so students can monitor their products (Winne & Hadwin, 2008). Judgments can be categorized as good or bad, depending on the evaluation which can then affect how students feel about the process.

Mental health has not been explicitly described in the COPES architecture to date. I posit mental health is an internal *condition* or self-factor, along with, for example, cognition, motivation, emotions, and beliefs. Mental health is an internal condition that (a) influences students' task perceptions in Phase 1 of SRL, (b) affects the standards used during metacognitive monitoring, and (c) can be the target of goals to regulate during learning, just like cognition (Winne, 2018). Further, as the *products* students create during learning and studying using cognitive *operations* are *evaluated* based on self-set *standards*, mental health may be entwined with all micro-level and macro-level phases of SRL. Thus, isolating specific aspects of the SRL phases or the COPES architecture implicated in mental health may need to consider both holistic and reductionist approaches in examining the interplay between mental health and SRL, such as during studying episodes at university.

This dissertation conceptualizes SRL using Winne and Hadwin's (1998) 4 phase SRL model for three reasons. First, this model places monitoring and evaluating at the centre of the model, emphasizing the metacognitive aspect of SRL throughout all phases. By highlighting the importance of metacognition in learning, students using this model can monitor and evaluate their learning progress as well as their mental health around academic tasks and challenges. Next, Winne and Hadwin's (1998) model acknowledges learner beliefs, perceptions, and experiences become

important conditions guiding regulatory engagement. At the same time, beliefs, perceptions, and experiences are products of regulatory cycles of engagement. Students' beliefs, perceptions, and experiences may also be associated with mental health. Mental health is most certainly affected when learners struggle to understand what is expected, fail to break tasks down into challenging and achievable goals, persist with effortful but ineffective strategies, and lack the metacognitive awareness or knowledge necessary to make adjustments to attain success. Finally, this model has practical relevance for guiding success in university settings (see Hadwin & Winne, 2012) as research on university students' studying informed its creation. This is critical to examining student success in university as the SRL model guiding the research can also be used by students themselves to guide their learning. Taking control of learning during challenges at university by leveraging SRL strategies and processes has potential to (a) shape students' perceptions of mental health in situ, and (b) facilitate student success.

SRL and Mental Health

Limited research exists on SRL and mental health, particularly using Keyes' dual-continua model of mental health (2005) and Winne and Hadwin's 4 phase SRL model (1998; Hadwin & Winne, 2012). Reviewing the limited previous research can provide important clues for guiding future studies. Howell (2009) examined mental health and SRL by conceptualizing mental health according to Keyes' (2005) dual factor continua. The purpose of the study was to examine how university students' mental health predicted cognitive and behavioral processes indicating an aptitude for SRL processes and strategies. Students completed measures of psychological, social, and emotional well-being as well as measures of entity beliefs, goal orientation, and procrastination. Findings indicated students with flourishing mental health had the highest levels of overall adaptive academic functioning (Howell, 2009). Adaptive academic functioning in this study was defined as students who have incremental beliefs about ability (i.e., growth mindset), set mastery-approach goals, report low levels of procrastination, and have high self-control. In another study, Grunschel

et al. (2016) found students' use of motivation regulation strategies indirectly affected academic performance and well-being. Findings from this study indicates students' use of motivation regulation strategies may reduce procrastination and raise academic performance, adaptive functioning, and well-being. Together, findings from these two studies indicate positive functioning and positive feelings about academic functioning are integral to mental health.

Psychopathology and SRL

Research on psychopathology, the study of mental disorders, may also provide indirect evidence linking self-regulated learning to mental health. Research indicates university students who experienced high levels of psychological distress reported low persistence when they experienced failure or challenges to complete academic tasks (Brackney & Karabenick, 1995). Furthermore, these students did not seek academic assistance when they needed help, and experienced reduced motivation and ability to use learning strategies that could have positively influenced their performance. Additionally, van Nguyen et al. (2015) found medical students who reported using more SRL strategies as measured by the MSLQ (Motivated Strategies for Learning Questionnaire; Pintrich et al., 1991) also reported lower rates of depression. These two studies establish interest in understanding the relation between mental health and SRL more broadly. However, a limitation is these studies assessed symptoms of mental disorders rather than using Keyes' (2005) conceptualization of mental health or measure.

Identifying Gaps in the Research on Mental Health and SRL

The slim body of existing research reveals the potential benefits of further understanding the interplay between mental health and SRL in university and student success. However, in order to make meaningful theoretical and empirical contributions in these areas, we need to move beyond simple correlational studies between mental health and SRL. Rather, studies need to incorporate current conceptualizations and measurement approaches used in SRL research, and mental health instruments that do not conflate mental health with mental illness. Three critical themes have yet to

be examined in research examining the interplay of mental health and SRL: (1) recognizing mental health and SRL are both dynamic processes that develop over time, (2) situating this research in learning contexts, and (3) highlighting the role of metacognitive interventions in understanding the role of mental health in SRL.

Dynamic Processes Developing over Time

The conceptualization and operationalization of SRL as an aptitude fails to recognize the emerging and adaptive nature of SRL as a process evolving over time and in dynamic interplay with both the feelings and psychological and social functioning characterizing mental health. For example, both Howell (2009) and Grunschel et al. (2016) measured SRL as an aptitude at one time point in a semester, using the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991). Most current SRL research attempts to capture SRL as event-based processes using multiple objective and subjective data sources (Winne & Perry, 2000). Conceptualizing SRL as event-based indicates challenges are the ideal moment to examine SRL as challenges are when students may become aware the processes and strategies they have been using need to be adjusted, updated, or adapted to proceed. A final limitation is mental health was only measured at one time point rather than multiple time points to reflect fluctuations in mental health that may occur over time, especially during a university semester. Grunschel et al. (2016) indicate a longitudinal design is ideal for research examining SRL and well-being, and future studies should assess students' well-being and other indicators of SRL at different points of time.

Situating Research During Learning

Shifting students' perspective of mental health from something they experience to something they can learn to actively control and self-manage during learning has implications for (a) how we measure mental health during learning, and (b) the assumptions that inform the way we model the constructs involved (e.g., goal attainment, engagement, strategy use). Academically successful students believe they have influence over how they behave in academic environments (Bandura et al., 1996). Thus, self-regulatory skills contribute significantly to success only when

students realize they need to use these skills, strategies, and processes when they encounter difficulties, stressors, and challenges. Mental health promotion programs on university campuses around the world have contributed greatly to research by targeting out-of-classroom contexts (e.g., Blee et al., 2015; Conley et al., 2015; Viskovic & Pakenham, 2018). Research taking place during learning has the potential to not only contribute to understanding student success and SRL, but to also unpack the relation between mental health and learning. Importantly, this is not to say students can learn to self-regulate symptoms of mental illnesses. Rather, if students are aware their social, psychological, and/or emotional well-being is at risk due to academic challenges, they may be able to leverage SRL processes and strategies to be successful. Finally, this does not mean examining learning only during structured class time but could include students' plans and reflections on studying or learning wherever and whenever it occurs.

The Role of Metacognitive Interventions

The implications of the overlap between metacognitive knowledge and experience are important in both SRL and mental health research. For example, asking students to report on their internal beliefs and perceptions of actions, states, processes, etc., during learning prompts metacognitive awareness and is simultaneously considered a metacognitive intervention. When students experience a challenge, they may try new strategies, revise their goal, and/or revisit their knowledge of the task through the monitoring and evaluating of their progress to date. Asking students to reflect on these processes also may influence students to consider using these processes in the future. Similarly, when students self-assess their mental health, for example through an instrument or survey, metacognitive monitoring and awareness are also prompted. Increasing mental health awareness in students underemphasizes the importance of fostering self-awareness of one's own mental health. Thus, adding mental health to the knowledge, beliefs, and experiences students have during learning could potentially affect metacognitive knowledge and awareness of mental health around student success. This could be because mental health may constrain or facilitate the leveraging of SRL processes and strategies or vice versa. Metacognitive interventions,

such as online SRL diary tools (see Schmitz et al., 2011) have the potential to help unpack this interplay further.

In sum, three gaps were identified by reviewing theory and research from the fields of SRL and mental health. The few studies in this area provide evidence mental health plays a role during learning, however further research is needed to understand more about how these dynamic processes shift over time and the role of metacognition in monitoring these processes. Thus, one of the aims of this dissertation was to examine the interplay between self-regulated learning and mental health in student success at university.

Chapter 2: Methodological Considerations

Establishing the theoretical connections between SRL and mental health highlights opportunities for research to contribute to the fields of mental health, SRL, and student success. However, many methodological challenges appear due to this novel convergence of topics. Thus, a second aim of this dissertation was to explore a variety of methods and analyses examining this interplay. In this chapter, I (a) describe the importance of conducting this research with university students in a learning-to-learn course, (b) evaluate current approaches to measuring SRL and mental health, (c) select the main SRL measurement approaches, the online SRL diary tool and the mental health measures, and (d) summarize the methodological considerations in this dissertation.

Researching SRL and Mental Health with University Students

The university student demographic is ideal for targeting mental health promotion efforts as 75% of mental disorders appear before the age of 24 (OECD, 2012). Regardless of whether students have a mental illness, students at university are particularly vulnerable to several risk factors for languishing mental health: social isolation, rapid social change, unhealthy lifestyles, and/or stressful working conditions (Keyes, 2003, 2005). University students' mental health is an essential component of academic success, and teaching students to actively maintain their mental health "sets the foundation for increased ability to sustain well-being throughout their lives" (CACUSS & CMHA, 2013, p. 7). Thus, promoting mental health as something university students have the potential to optimize puts students in control and makes them active participants in self-management. In addition, students who are academically successful (a) believe they have influence over how they behave in academic environments (Bandura et al., 1996), and (b) need to use self-regulatory skills, strategies, and processes to be successful when they encounter difficulties, stressors, and challenges.

The university environment provides many opportunities for examining how students navigate challenges, particularly academic challenges. At university, students may face myriad

challenges, including establishing autonomy from parents/guardians, forming new relationships, adjusting to a new social environment, mastering new curriculum, developing career plans, and managing priorities and pressures related to personal, academic, financial, and social needs (see Conley et al., 2013). Specifically with academic challenges, students must navigate (a) transitioning from the structured secondary school environment to the unstructured postsecondary environment, (b) mastering complex content in one or more discipline, and (c) attaining difficult goals by monitoring and regulating their cognition, behaviour, and motivation (Hadwin & Winne, 2012, p. 201). The challenges students face during studying provide ideal opportunities to examine SRL (Hadwin et al., 2011; Järvelä & Hadwin, 2013). However, university students often lack the self-regulatory behaviours and skills required to manage their learning (e.g., Ben-Eliyahu & Linnenbrink-Garcia, 2015; Boekaerts & Corno, 2005; Hadwin & Winne, 2012), and these skills are rarely explicitly taught in formal educational environments (Schunk & Greene, 2018, p. 13). As the role mental health plays in SRL is underexamined, conducting this research in a context where SRL is being explicitly taught and developed is beneficial to understand this interplay.

Research Context: A University Learning-to-Learn Course

A university learning-to-learn course is the ideal environment to examine the role of mental health in SRL. Students learning to regulate their learning make ideal research participants as they will exercise more variability in the ways they evidence using SRL strategies and tactics than students developing SRL on their own (Winne, 2014). In addition, students need to be active in their learning process, including regulating and controlling their cognition, emotions, motivation, and behaviours in the pursuit of academic goals (Pintrich, 2000). University students may be considered an overused, convenience sample in educational psychology research, however learning-to-learn courses based on SRL theory at the university level are not common. Therefore, conducting research in this context may have important implications for both the instruction of SRL at the university level and understanding the interplay between SRL and mental health. However, when students take a course on SRL (i.e., a learning-to-learn course), they are learning about SRL theory

and principles as well as how to apply these concepts to their own studies in order to be more successful, often through SRL interventions in the course. Hattie et al. (1996) suggest effective learning interventions are situated in a relevant learning context, include domain-relevant tasks, and promote metacognitive awareness. SRL interventions seek to enhance student learning through engagement with SRL processes and strategies and highlight the role of metacognitive monitoring and evaluating. Developing metacognitive awareness of strengths, weaknesses, processes, and outcomes sets the stage for strategically optimizing goal progress, academic success, and potentially mental health.

As SRL consists of complex processes, students need tools and methods to keep track of their own learning data they can use themselves to recognize patterns in their behavior and make changes (Winne, 2005; Winne & Hadwin, 1998). Each SRL event is a potential experiment where the student can collect data, access tactics and strategies, and have opportunities to practice newer tactics/strategies to bring them to automaticity (Winne, 2018). Thus, using SRL interventions throughout an SRL course helps guide students on how to gather, interpret, and reflect on their learning and potentially mental health for current and future academic use. Thus, selecting measurement approaches should consider the dual-purpose use of both data collection and as an SRL intervention for students learning to SRL. Further, findings gathered from students enrolled in a university learning-to-learn course could then be used with the general student population once meaningful interventions are identified.

Approaches to Measuring SRL

SRL encapsulates a myriad of internal processes during learning (e.g., behaviour, cognition, motivation, emotion), therefore measuring the complexity of these internal processes is challenging (Boekaerts & Corno, 2005). Panadero et al. (2016) describe three identifiable, interwoven waves of how SRL measurement has evolved over time. First, in the 1980s and 1990s, SRL was conceptualized as static and relied on aptitude-based self-report instruments measuring students'

perspectives and beliefs about their learning. Aptitude-based measures (a) consider SRL as a stable trait in students that can predict future academic achievement, and (b) assess how learners engage in regulatory processes across time and contexts (Winne & Perry, 2000). Examples of broad, self-report measures given at one time point are the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991) and the Learning and Study Strategies Inventory (LASSI; Weinstein & Palmer, 2002). The MSLQ aims to assess students' motivations and use of learning strategies, whereas the LASSI is used to help students diagnose their learning strengths and weaknesses. These types of self-report instruments in SRL research are not meant to capture all processes and strategies engaged in SRL; instead, they focus on aspects of SRL (Wolters & Won, 2018). Strengths of these approaches include the ease of administration to large amounts of student, and the quick scoring and analyzing of data afterwards (see Wolters & Won, 2018). Limitations include questions about validity of these measures in relation to other educational processes.

In the second wave of measurement, starting in the late 1990s, SRL was considered as a dynamic series of events developing or changing over time (Panadero et al., 2016). Validity concerns surrounding aptitude-based measures helped move SRL measurement to event-based (Winne & Perry, 2000). Event-based self-report measures in SRL research commonly use fine-grained measurements of learning instances, such as a single two-hour study session or a hypermedia learning session (e.g., an open-ended online environment teaching students about biology). Defining the grain-size of the event is debated within the SRL literature (e.g., McCardle et al., 2012). Event-based measures aim to measure how students' behavioural, cognitive, motivational, emotional, and/or metacognitive processes are or are not engaged during learning and consider the event to have a beginning and an end. Two examples of event-based SRL measurement approaches include think aloud protocols and multimodal data collection.

Think aloud protocols (TAPs) require individuals to verbalize and report their thoughts during an event, or learning activity (Greene et al., 2015). The TAP is administered by a researcher and can consist of the researcher providing prompts to the student to elicit responses or elaborate in

order to capture SRL processes (Greene et al, 2011). For example, a student may receive instructions on the TAP from the researcher to explain how the student can speak aloud as they think about a task. The student may comment that they are thinking about what to do, what the instructor said about the task, what the students' goals are, etc. At times, the student may stop talking and the researcher may need to prompt the student to continue talking. The outcome of the TAP is a transcript of the student's verbal descriptions of their learning. The transcript can then be coded and/or categorized into indicators of SRL, usually by a specific SRL model. TAPs can help students monitor and control their SRL and identify effective strategies, as well as help educators understand how students interpret assignment instructions (Greene, et al., 2011). Strengths of TAPs include they occur in situ during learning (i.e., rather than before or after), and they are open-ended because there are no predetermined questions for students to answer (Greene et al., 2015). Limitations include the time and resource intensive nature of collecting and preparing data, which could require 4-6 hours of work per 30-minute learning activity (Greene et al., 2011).

Multimodal data collection is another event and process-based way to measure SRL through collecting physiological data (e.g., heart rate, eye tracking, facial expressions, audio, video, etc.) and log file data (e.g., clicks in an online environment, time on task) as objective measures of SRL. For example, hypermedia tools allow researchers to capture the unfolding processes of SRL identified in students through several data sources such as think alouds, video and audio time-stamp data, and log file data (see Azevedo et al., 2010). These tools emphasize the process-based nature of learning during events that are considered to have both beginnings and ends. The richness of the multimodal data collected is contributing substantively to the field of SRL research in a variety of contexts, for example in collaboration (e.g., Malmberg et al., 2019), emotion and motivation in clinical environments (e.g., Lajoie et al., 2019), and students' listening and speaking behaviours online (e.g., Wise & Hsiao, 2019). Ultimately, these multimodal data attempt to capture both the processes and the facets engaged during self-regulation (Hadwin, 2019). However, (a) measuring SRL objectively through these methods does not mean they are free of measurement bias, and (b)

understanding SRL is dependent on measuring individuals' subjective interpretations of tasks, contexts, and their beliefs and values around learning (Reimann, 2019). Finally, these methods require a large upfront technological investment, including video and audio equipment, as well as advanced training in converging data sources from multiple channels.

The third wave emphasizes measurement tools that both promote SRL and measure students' engagement with SRL processes and strategies. These methods go beyond their function as solely measuring SRL and also serve as interventions (Panadero et al., 2016). One example is the learning diary, or the online SRL diary tool. In online SRL diary tools, students plan their studying activity and then, after finishing the activity, reflect on what went well with their studying, and what did not go well. Diary tools are useful for measuring SRL over time, improving transfer, and improving metacognition (e.g., self-monitoring) and motivation in small increments (Schmitz et al., 2011). Using diaries are effective especially in contexts where students are learning about SRL and making changes to their learning (see Fabriz et al, 2014). Ecological validity of diary tools can be high, especially if the tools are completed before, during, and/or after the learning episode (Schmitz et al., 2011). Critiques of online diary tools include that it is based on self-report data and external validity of the data can be reduced if only highly motivated students complete the tools (Schmitz et al., 2011).

Reviewing the three waves of measuring SRL resulted in identifying four main measurement options: aptitude-based measures, such as the MSLQ; event-based measures, such as TAPs or multimodal data collection; and intervention approaches, such as the online SRL diary tool. The methods used in this dissertation needed to address the critical themes outlined in chapter one and needed to be suitable for the research context of a university learning-to-learn course occurring in real time during a semester. Thus, there were three considerations for methods measuring the interplay of mental health and SRL in this dissertation: (a) the methods should be useful and practical for students, (b) the methods should guide students toward increased metacognitive awareness of their learning approaches so students can make changes as necessary,

and (c) the methods should make data available for interpretation by students before, during, and/or after the tools are completed. Table 3 provides a summary of how the four measurement options fulfill these requirements.

Table 3

Summary of how SRL measurement approaches fulfill method requirements

Requirement	Aptitude-based measures (e.g., MSLQ, LASSI)	Multimodal data collection	Think aloud protocol (TAPs)	Online SRL diary tool
Critical Themes from Chapter 1				
Considers SRL and mental health as dynamic processes developing over time	No, as SRL is measured at one timepoint and mental health is not included.	Yes, as it considers SRL and other facets as dynamic with the potential for mental health.	Maybe, if students are prompted to report on their mental health and their SRL engagement.	Yes, if the tool is completed on a regular basis over time.
Situates research during learning	No, as it is taken as a questionnaire outside of learning.	Yes, as all data are collected during learning events.	Yes, as students are actively learning and explaining their thought process.	Yes, as the tool requires students to plan for and reflect on their learning.
Highlights the role of metacognitive interventions	No, as it is not an intervention.	No, unless there is a metacognitive intervention as a part of the study.	Maybe, if the TAP is explained as a metacognitive intervention.	Yes, as the diary is a metacognitive intervention
Research Context				
Measurement approach is useful for students	Maybe, if students learn about SRL from the questions asked.	Yes, if students have immediate access to their data and it is easily interpretable.	Yes, as it may encourage students to engage more with the learning activity.	Yes, as students use it to record their learning over a period of time.
Prompts metacognitive awareness in students	Maybe, if students learn about SRL from the wording of the questions.	Maybe, depending on how data are collected about metacognition.	Yes, as students are verbalizing their thoughts about their learning.	Yes, if questions prompt students' metacognition around their learning.
Data/tool available for students before/during/after learning	Maybe, if the scales are interpreted and shown to students online immediately after taking it.	Maybe, if the multiple data channels are converged in real time and interpretable by students.	No, as TAPs require time intensive coding and analysis.	Maybe, if students can access all their completed diary tools and if they receive instruction on how to use their learning data.

Based on how well the reviewed measurement approaches fit the critical themes and research context, the aptitude-based measures and multimodal data collection were eliminated. First, the aptitude-based measures did not fit enough of the criteria to warrant inclusion, in particular because none of the three critical themes addressed in chapter one would be addressed by using these tools. In addition, previous research has already established connections between SRL aptitude-based measures and mental health (e.g., Howell, 2009) or psychopathology (e.g., Brackney & Karabenick, 1995) to provide a basis for this dissertation. However, the second purpose of this dissertation is to explore a variety of methods and analyses examining the interplay between SRL and mental health. Thus, using methods that have not been used before have the potential to add to the slim body of knowledge on this topic.

There is a lack of research on mental health and SRL using objective multimodal data collection methods. Multimodal data collection in SRL relies primarily on objectively collected data about individuals to draw conclusions about their behaviour, cognition, metacognition, motivation, and affect during learning. Multimodal data does not always highlight the role of metacognitive interventions nor prompt metacognitive awareness, and due to the complexity of these data, students may not be able to interpret the findings. For mental health, there are objective ways to measure mental health, for example heart rate variability (e.g., Geisler et al., 2010), and clinician or acquaintance ratings (e.g., Nave et al., 2008). Heart rate variability is one data source for multimodal data used during SRL research, but for mental health, it is usually used in combination with self-report instruments. These objective ways of measuring mental health could provide participants with objective information about their mental health or how others view their mental health. However, it is unrealistic for large studies to procure weekly acquaintance or clinician assessments of all participants in an academic university student context. Thus, mental health objective measures may be limited in their scope depending on the length of the study and may not capture daily or weekly fluctuations in mental health. Therefore, multimodal data was eliminated as an option because the critical themes and research context for this dissertation

determine that starting with students' subjective responses around both their learning and their mental health is an ideal starting point.

In comparing the two final approaches, the online SRL diary tool (e.g., Hadwin et al., 2019; Hadwin & Webster, 2013; Hadwin & Winne, 2012; McCardle et al., 2017) and the TAP, the online SRL diary tool was chosen for three reasons. First, the diary tool can be designed to be completed before, during, and/or after the learning episode as it is self-administered online. TAPs produce large amounts of complex data collected during a learning episode that need to be coded, thus requiring extensive resources (Greene et al., 2015). The TAP requires someone else to administer the protocol, so administering weekly TAPs to a class of students is impractical. Second, the online diary tool builds self-monitoring into the design. When students complete one week of the diary tool, they are engaging in self-observation by recording what they did during a study session and reflecting on the SRL processes and/or strategies with which they engaged. With the TAPs, this monitoring may be prompted by a third-party researcher's questions to prompt students. Students could certainly apply this metacognitive process to their own work outside of the TAP, however, the bulk of the TAP relies on the prompted interaction between the student and the TAP administrator, rather than just the internal reflective process of the student. Third, in investigating the interplay between SRL and mental health, some students may not be willing to discuss their mental health with another, unknown person to them due to the stigma surrounding mental health. Thus, having a private method such as a diary tool to reflect on mental health and learning may benefit students by providing them an opportunity to give honest answers they may otherwise be uncomfortable sharing with a TAP administrator. In summary, the online SRL diary tool was selected as the main measurement method for this dissertation to address the critical themes identified in table 3.

The SRL Diary Tool: The MyPlanner

The MyPlanner (Hadwin et al., 2012; Hadwin et al., 2018; Hadwin et al., 2019; Webster & Hadwin, 2012) is an online SRL diary tool based on Winne and Hadwin's (1998) model of SRL. The primary purpose of the MyPlanner is to foster metacognitive awareness in students by prompting them to take control of one study session by planning and reflecting. The MyPlanner guides students' planning through a series of questions containing drop-down menus and open-text fields. This type of question construction is called a narrative constructor and after completing the items, students can see a paragraph containing their self-selected choices for each question. In the reflection section, students respond to a series of questions about the progress made toward their self-set goal, the challenges faced, and strategies used. The complete set of questions in the MyPlanner can be viewed in Appendix A3.

Validity of the MyPlanner

Wolters and Won (2018) outline how the five main types of evidence of construct validity in the Standards for Educational and Psychological Testing (AERA, APA, & NCME, 2014) can be addressed through SRL self-report questionnaires. The five types of evidence of construct validity are content, response processes, internal structure, relations with other variables, and consequences of the testing (AERA, APA, & NCME, 2014). Wolters and Won (2018) refer to broad, aptitude-based SRL self-report measures, rather than event-based SRL measures such as the MyPlanner. However, these types of construct validity evidence can be determined for the MyPlanner, specifically content and response processes.

Content validity requires a match between what is being assessed to the theoretically important aspects of SRL (ACHA APA, & NCME, 2014). Winne and Perry (2000) also highlight the importance of gathering empirical feedback using measures informed by models and measurement considerations. The MyPlanner is rooted in the Winne and Hadwin (1998) 4 phase model of SRL emphasizing the roles of metacognitive monitoring and evaluating in planning for and reflecting on a single study session. In addition, Wolters and Won (2018) posit content being

assessed on self-report measures of SRL should vary along with tasks, contexts, and/or domains. The MyPlanner takes into consideration SRL processes vary across tasks, contexts, and/or domains due to the individualized nature of the questions where students select the task, context, and/or domain for their study session. For example, a student could plan to study for an upcoming exam (i.e., task) taken online as an open book exam (i.e., context) for their psychology course (i.e., domain).

Response processes validity requires alignment between the processes individuals use to complete an assessment (e.g., motivation, mental health) and the purpose of the assessment (e.g., to measure motivation or mental health). Response processes refer to the cognitive and psychological processes individuals engage when they complete a measure. The MyPlanner aims to guide students through a metacognitive intervention of planning a study session and reflecting on their progress. Students self-report and select the important SRL processes and strategies implicated in their individual study sessions on the MyPlanner. Tracking this kind of data for students can be helpful in highlighting where their regulation successes and failures occur.

Previous research using the MyPlanner has provided empirical feedback about the response processes validity of the MyPlanner (e.g., McCardle et al., 2015; Webster & Hadwin, 2015). McCardle et al. (2015) examined students' goal-setting on the MyPlanner and found students' overall self-set goals in MyPlanners across a semester tended to be vague and lacked improvement over time. One explanation for this finding is students in university are often unprepared for the new learning contexts and challenges at university, and as a result often do not spend sufficient time monitoring and evaluating their task perceptions of informal and formal tasks, leading to poor goal-setting and ineffective strategy selection (Hadwin & Winne, 2012). In McCardle et al., (2015), students' answers to the open-ended and guided narrative constructors (i.e., response processes) on the MyPlanner mirrored theory and research based on the 4 phase model of SRL: students often do not spend sufficient time or effort understanding tasks, which can lead to setting ineffective goals.

Webster and Hadwin (2015) examined students' emotions and emotion regulation strategies on the MyPlanner. They found positive emotions were predictive of self-evaluation of goal attainment. Emotions are considered to be internal conditions for each phase and products of each phase in the Winne and Hadwin (1998) COPES framework. The emotions students reported in Webster and Hadwin's (2015) study were consistent with this framework. Students who reported experiencing a positive emotion during a study session were more likely to have attained their goal. This is in line with previous empirical research where students' emotions are connected to students' perceptions of their progression during studying (see Pekrun et al., 2010), and post-studying performance perceptions (see Boekaerts, 2007). Thus, content and process response validity can be evidenced in previous research using the MyPlanner, and the research in this dissertation aims to add to the evidence of its validity.

Reliability of the MyPlanner

Reliability in measurement is usually determined by consistency across measurement instances or inter-rater agreement. However, consistency and stability are challenging to apply to SRL measures because of the adaptive, cyclical nature of SRL and because SRL may vary over time and in different contexts (Winne & Perry, 2000). The MyPlanner is a metacognitive intervention that asks students to report on internal beliefs and perceptions of actions, states, processes, etc., by invoking metacognitive awareness. Additionally, students in the learning-to-learn course are using the MyPlanner to guide one two-hour study session weekly throughout the semester. Students are not only taking multiple courses with numerous tasks they may need to study for, but they also may actively be making changes to their learning approaches using course concepts and knowledge of SRL theory. Thus, reliability would be established for the measures that are included in the diary, rather than the diary as a measurement tool assessing a single construct. Measuring mental health in the diary tool requires comparing mental health measures and choosing the one most suitable to include in the tool and in the research context.

Approaches to Measuring Mental Health

Mental health has predominantly been measured by Likert scale self-report on a series of questions or statements. Researchers consistently disagree with how to define and operationalize mental health and well-being (e.g., Goodman et al., 2017; Linton et al., 2016). Well-being is recognized as a multidimensional phenomenon including aspects of both hedonic (i.e., positive feeling) and eudaimonic well-being (i.e., positive functioning; Ryan & Deci, 2001). However, some measures only capture one or two of these dimensions (e.g., life satisfaction, positive affect, or happiness). In selecting measures for mental health for this dissertation, unidimensional measures of psychological, emotional, and social well-being and multidimensional measures of mental health were compared (see Table 4). Table 4 compares examples of unidimensional and multidimensional mental health and well-being measures. For the unidimensional measures, these focus on psychological well-being or emotional well-being, but do not include social well-being. For the multidimensional measures, the Pemperton happiness index is not based in a model of mental health, but rather tries to include multiple aspects of well-being (see Hervas & Vazquez, 2013). Overall, the reliability of these measures ranges from having a Cronbach's coefficient α of .80 or higher, indicating good to excellent scale reliability.

Comparing multiple measures revealed some of the multidimensional measures comprise the unidimensional measures. For example, Keyes' (2009) Mental Health Continuum-Short Form includes six items from Ryff's (1989) psychological well-being scale. In addition, there may be overlap in the interplay between psychological well-being and SRL due to the combined focus on positive functioning, autonomy, self-control, and goal attainment (Howell, 2009). Thus, comparing psychological well-being and SRL in particular may inform research on overall mental health and SRL.

Table 4

Comparison of mental health and well-being measures

Name of measure	Factor(s) of mental health			Number of items	Reliability (α)
	Psychological well-being	Social well-being	Emotional well-being		
Unidimensional measures					
Scales of Psychological well-being *Ryff, 1989*	x			120 (6 scales)	.86-.93
Psychological well-being *Rush and Grouzet, 2012*	x*			9 (1 scale)	.91
Positive and Negative Affect Scales *Watson et al., 1988*			x	20 (2 scales)	.84-.90
Satisfaction with Life Scale *Diener et al, 1985*			x	5 (1 scale)	.87
Multidimensional measures					
Pemperton happiness index *Hervas and Vazquez, 2013*	x	x	x	21 (2 scales)	>.89
Mental health continuum-Short Form *Keyes, 2009*	x	x	x	14 (3 scales)	>.80

*Note: *5 items from Flourishing Scale (Diener et al., 2010), four items from Ryan and Frederickson (1997), and one item from Waterman (1993).*

Guidelines for selecting mental health measures for this dissertation were informed by previous reviews comparing well-being measures (e.g., Cooke et al., 2016; Linton et al., 2015).

However, neither of these two reviews recommended a specific instrument, but rather highlighted (a) the inconsistencies in terminology and operationalization and measurement of mental health, and (b) the importance of using clear definitions and theoretical frameworks in defining well-being. In addition, using instruments that can differentiate between levels of well-being (i.e., low levels versus high levels) may be especially advantageous and useful (see Cooke et al., 2016).

As established in chapter one, this dissertation uses the World Health Organization's (2016) definition of mental health as a state of well-being in which individuals cope with stressors, work productively, and contribute to society (WHO, 2016). Further, this dissertation conceptualizes mental health using Keyes' (2005) dual-continua model of mental health which (a) comprises psychological, social, and emotional well-being, and (b) establishes mental health and mental illness as separate, yet related constructs. Based on these criteria, two instruments were chosen to measure mental health and well-being in this dissertation: Keyes' (2009) Mental Health Continuum-Short Form, and Rush and Grouzet's (2012) psychological well-being scale.

The Mental Health Continuum—Short Form

This dissertation uses the Mental Health Continuum-Short Form (MHC-SF; Keyes, 2009), which includes both eudaimonic and hedonic well-being perspectives. The MHC-SF is based on a mental health theoretical framework (Keyes, 2005), and has a clear definition and cut-off scores indicating flourishing, moderate, or languishing mental health. This instrument contains three scales, measuring both hedonic (i.e., emotional well-being) and eudaimonic approaches (i.e., psychological and social well-being). Individuals taking the MHC-SF respond to 14 items asking them "During the past month, how often did you feel the following ways", with responses on a 6-point scale ranging from never to every day (Keyes, 2009). Items 1-3 measure emotional well-being through assessing positive affect, interest in life, and life satisfaction. Social well-being is measured by items 5-8 and is based on Keyes' (1998) model assessing social acceptance, social actualization, social contribution, social coherence, and social integration. Finally, items 9-14 represent

psychological well-being of Ryff's (1989) model of autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance. Used with both adolescents and adults across different cultures, this scale has excellent internal consistency (>.80; Keyes, 2005, 2006; Keyes et al., 2008; Lamers et al., 2011; Westerhof & Keyes, 2009).

The MHC-SF can be scored continuously or categorically using Keyes' categories of flourishing, moderate, or languishing mental health (Keyes, 2009). Individuals with high levels of at least one measure of emotional well-being and at least six measures of psychological or social well-being are flourishing. Languishing individuals are identified as having low levels on at least one measure of emotional well-being and low levels on at least six measures of psychological or social well-being. High scores are defined as in the upper tertile and low scores are described as being in the lower tertile for each item (Keyes, 2002, 2005). For this dissertation, students were asked "During the past week, how often did you feel the following ways" and responded on a 5-point scale (i.e., instead of a 6-point scale in the original measure due to the time period being a month) ranging from never to every day.

In addition, research using this measure has determined that poor (i.e., languishing) mental health may put individuals at risk for a mental illness over time. Previous research has shown that adults with languishing mental health were found to be six times more likely to develop a mental illness after ten years compared to adults who had moderate or flourishing mental health (Keyes et al., 2010). Thus, using this measure with university students who are at risk for poor mental health has the potential to identify students who are continually languishing and may be at risk for developing a mental illness.

Psychological Well-Being Scale

As previously discussed, psychological well-being may be of particular interest in SRL research (Howell, 2009). Even though mental health comprises three factors, psychological well-being may have the strongest association with adaptive regulation of learning. Howell (2009)

recognizes there may be some overlap between the psychological well-being scale and measures of goal orientation, self-control, and implicit theories. Further, several dimensions of psychological well-being may be explicit when aiming to attain goals (i.e., autonomy, purpose in life, environmental mastery) indicating this may be a particularly salient line of future research to inform theory.

For measuring psychological well-being (PWB), this dissertation uses Rush and Grouzet's (2012) measure. This measure was chosen because (a) previous research has used this measure for daily repeated measures research, (b) this scale has 9 items for PWB compared to 6 items in the MHC-SF to increase the validity of the scale, and (c) the MHC-SF is a multidimensional instrument and only using the PWB questions is not how the scale was designed to be used. This measure was created by combining items from established measures of functioning (i.e., the Flourishing Scale, Diener et al., 2010; optimal functioning, Ryan & Frederick, 1997; and personal expressiveness, Waterman, 1993). In this dissertation, individuals were asked to rate on a 7-point scale how they were doing this week, where one indicated not at all and seven indicated very much. Items included *I am engaged and interested in my activities* and *I feel competent and capable in my activities*. Internal consistency reported was excellent (>.90; Rush & Grouzet, 2012). Additionally, as many aspects of psychological well-being relate to learning, students may be able to see the link between their psychological well-being and SRL more clearly through metacognitive awareness of their goals and purpose. Similarly, researching how students with different levels of psychological well-being attain goals and the types of challenges and strategies they report could provide information if there is overlap between psychological well-being and aspects of SRL.

Mental Health Measures in the Online SRL Diary Tool

In this dissertation, decisions had to be made as to when and how often mental health should be measured. SRL diary tools measure situations in which learning is occurring or right after learning occurs. In mental health research, studies may examine daily fluctuations (see Rush & Grouzet, 2012) or measure mental health at only one time point to compare to other constructs

(e.g., Howell, 2009). However, measuring mental health at more than one time has potential to reveal changes and processes rather than overemphasizing states. When measuring daily well-being and examining within-person associations, eight measurement bursts are common in the literature (Rush, 2018). An important theoretical guideline for measurement was to consider SRL and mental health as potentially operating in tandem and thus should be measured simultaneously. Therefore, the mental health measures were added to the beginning of the MyPlanner before students moved onto answering other questions planning their study session. Measures capturing indicators of SRL and mental health at multiple time points across an academic semester have the potential to: (a) examine the relationship between self-regulatory skills/strategies and experiences of mental health to inform targets for SRL interventions, and (b) reveal within-student patterns such as languishing indicators of mental health worsening over time indicating students who are at-risk academically.

Summary of Methodological Considerations

In summary, reviewing measurement approaches to SRL and mental health led to the selection of the main data collection tool, the online SRL diary tool, and the selection of the mental health measures to be included in the diary tool. This dissertation aimed to (a) examine the interplay between self-regulated learning and mental health in student success at university, and (b) explore a variety of methods and analyses examining this interplay. Determining the population to study, what type of data to collect, and how to collect the data informed the design of this program of research. The research in this dissertation was a part of two larger research projects on student success at the University of Victoria, Promoting Adaptive Regulation for 21st Century Success (PAR-21) and Promoting Adaptive Regulation through Innovative Technologies (PAR-IT), both funded by the Social Sciences and Humanities Research Council of Canada. One aim of these larger studies included researching how technological tools can support students' success by investigating how individuals and teams monitor and regulate cognitive, socio-emotional, and behavioural processes maximizing success.

Approaching research on mental health from an SRL perspective has great potential to shift the focus *away* from mental health only as an outcome and *toward* mental health as an evolving state influenced by how learners take control of learning situations and the resulting challenges. To date, research examining the role of mental health in SRL has determined students with better mental health have higher academic performance and functioning and use more effective strategies (e.g., Grunschel et al., 2016; Howell, 2009). However, there is a paucity of research considering SRL and mental health as dynamic processes fluctuating over time, with the potential to make substantive theoretical and empirical contributions to understanding the role of mental health in SRL.

The methodological considerations addressed in this dissertation for research on SRL and mental health (a) recognize the current approaches in SRL research and advocate their use in measuring mental health, (b) identify the important role of students in the practical implications of how they can benefit from this research; and, (c) recognize the critical role of challenges to ignite students' metacognitive awareness about their success. They also highlight a crucial methodological implication: students having access to their own mental health data. As previously stated, it is not usual in mental health research for students to look at or interpret their results from mental health measures. Previous studies about mental health and SRL (i.e., Grunschel et al., 2016; Howell, 2009) do not indicate if students were taught about mental health or had access to their results from the research. Specifically, these studies do not specify (a) whether students have access to their scores on instruments or (b) how students could use this information to help themselves understand their mental health. This could be due to the focus on between-student comparisons, rather than within-student comparisons. However, students having access to their own mental health data has the potential to both inform individual student learning and help students recognize the importance of mental health to their success at university.

When students collect their own mental health data, it could help them detect patterns and make changes to their approaches as needed. This may be especially important if students develop

the metacognitive awareness their mental health is a barrier to their learning and they need to seek outside or professional help (e.g., counselling services, student health, etc.). This is why some SRL researchers prioritize students having access to their own learning data. Thus, it is important to establish what students do with information about their mental health and what role, if any, leveraging SRL processes and strategies plays in optimizing mental health at university.

In sum, research combining mental health and SRL affords several opportunities to understand how their interplay at university affects student success. There is a lack of research examining how SRL strategies and processes co-emerge with perceptions of mental health over the course of an academic semester as students navigate coursework and adjustment to university life. Changes in time may reveal natural fluctuations in mental health or evidence cyclical trends in maladaptive or adaptive responses to those states. Based on these methodological considerations, each study in this multi-paper dissertation informed the design and analysis of the subsequent study. First, Davis and Hadwin (2019; Manuscript 1) aimed to explore the interplay between psychological well-being and SRL as students plan for and reflect on their approaches to attaining self-set goals over nine consecutive weeks. This paper highlighted the benefits of using both between- and within-person approaches. Next, Davis et al. (2019; Manuscript 2) aimed to examine the between- and within-person interplay of psychological well-being and SRL at university employing multilevel models to explore within-person coupled change in an intensive repeated measures design. This paper employed a unique research design aiming at showing associations over time between psychological well-being and the other variables, rather than determining causal relationships. Finally, Davis et al. (2020; Manuscript 3) brings together findings from both these papers by adopting a case study approach to examine how students' mental health affects their engagement in adaptive regulation and evaluate the role students' mental health plays in their learning.

Chapter 3: Research Purpose, Context, and Manuscript Overview

Research Purpose

To date, limited research examines the interplay of mental health and self-regulated learning in student success during university. Therefore, the purpose of this dissertation was two-fold. First, this dissertation aimed to examine the interplay of mental health and SRL at university. Second, this dissertation explored a variety of methods and analyses examining between- and within- person differences in this interplay. Importantly, implications for this research are useful to students, educators, and researchers concerned with student success. The dissertation unfolds across three manuscripts that build upon each other to create an integrated program of rigorous mixed methods research (see Table 5 for a summary of the three manuscripts).

Table 5
Overview of the three manuscripts in this dissertation

Dissertation Purpose	To (a) examine the interplay between self-regulated learning and mental health in student success at university**,** and (b) explore a variety of methods and analyses examining between- and within- person differences in this interplay.		
Manuscript	Exploring differences in psychological well-being (PWB) and self-regulated learning (SRL) in university student success (Davis & Hadwin, 2019)	Examining associations over time between psychological well-being, academic engagement, and goal attainment (Davis, Milford, & MacDonald, 2019)	The role of mental health in adaptive regulation of learning and student success (Davis, Rostampour, Hadwin, & Rush, 2020)
Theoretical Gap Informing Each Study	Lack of research about the interplay between PWB and SRL during a semester, especially regarding attaining self-set goals.	Lack of research about overlap between goal attainment (student success) and PWB as within-person, over time processes evolving while learning.	Little research on how learning is affected or students' metacognition around their mental health and success
Research Purpose	This study aimed to examine the interplay between PWB and SRL as students plan for and reflect on their approaches to attaining self-set goals over nine consecutive weeks.	The purpose of this study was to examine the between- and within-person interplay of PWB and SRL processes at university.	The purpose of this cross-case comparison study was to examine mental health and adaptive regulation exhibited by two contrasting groups of students (i.e., the high mental health group and the low mental health group) in a university learning-to-learn course.
Research design	Between group and within-person comparisons (i.e., process mining).	Longitudinal analysis using multi-level modelling (i.e., coupled change models).	Case study approach using an extreme case sampling method.
Research Questions	1. Does PWB differ between groups of students with varying goal attainment? 2. What do the patterns of PWB and academic engagement reveal about the process of regulating learning over time?	1. Between students, how do the process variables of PWB, academic engagement, goal attainment, goal satisfaction, and mental health and well-being challenge predict academic performance in one course and in one semester? 2. How much variance in weekly PWB scores across a university semester is systematically between- vs. within-person? 3. Within students, can coupled-change associations across the semester be clearly demonstrated between PWB and ratings of academic engagement, goal attainment, goal satisfaction, and mental health and well-being challenge?	1. What challenges do students in each group report strategically addressing during study sessions? 2. What adaptive and maladaptive regulatory paths are engaged by students during study sessions? 3. How do students interpret their self-reported mental health as it unfolds weekly over an academic semester?
Data Sources	Self-report data from a weekly online SRL diary tool: the MyPlanner	MyPlanner data	MyPlanner data, open-ended questions about mental health, end of semester assignment.
Status	Submitted for second round of reviews (September 2020)	Submitted for publication (October 2020)	Manuscript ready for submission

Research Context and Ethics

Ethics approval was obtained for all studies and was conducted as a part of two larger research projects on student success, self-regulated learning, and promoting adaptive regulation at the University of Victoria: Promoting Adaptive Regulation for 21st Century Success (PAR-21), and Promoting Adaptive Regulation through Innovative Technologies (PAR-IT; see Appendix A for ethics certificates). Participants in the study were all consenting, enrolled students who were informed about the requirements to participate in the study and were provided with information to withdraw from the research study at any point in the semester (see Appendix B). Students received no incentives to participate in the research and all data collected were a part of regular course activities.

Participants were students registered in a learning-to-learn educational psychology course which required weekly attendance in an 80-minute lecture and an 80-minute lab. Topics discussed in the course included self-regulated learning framed in Winne and Hadwin's (1998) SRL model, motivation, learning and memory, reading, learning strategies, notetaking, exam studying, and other aspects of student success. These topics were introduced in lecture; during lab sessions students engaged with practical applications of concepts to their current courses. This credit-bearing, elective course is primarily taken by first year undergraduate students from across the university who are at all achievement levels. This course is not meant to be a remedial course for struggling learners, but rather aims to foster self-regulate learning strategies and processes for success at university for all learners. Any specific aspects of the research context relevant to each study are discussed in the manuscripts (see Appendix C).

Operationalization of Terms in the Manuscripts

Mental health and SRL were operationalized in slightly different ways across the three manuscripts (see Table $$). Mental health was operationalized the same across the three papers by situating mental health in Keyes' (2002, 2005) mental health model. However, it was measured

differently across the three papers. In Manuscripts 1 and 2, the psychological well-being factor of mental health was measured using Rush and Grouzet's (2012) measure. In Manuscript 3, all three factors of mental health (i.e., psychological, social, and emotional well-being) were measured using Keyes' (2009) Mental Health Continuum-Short Form.

Across all three papers, SRL was operationalized as a process of adaptively responding to challenges by applying and refining challenges, and actively engaging in learning activities. Academic engagement was considered to be an indicator of SRL and a critical marker for latter academic performance across all three papers. In Manuscript 1, this operationalization of SRL was augmented with measuring goal attainment, main challenge, and main strategy during 1-2 hour study sessions. In Manuscript 2, goal satisfaction and rating of mental health and well-being challenge were added. Finally, in Manuscript 3, students' evaluations of their strengths and weaknesses of their mental health during the semester were included, however since it was in the context of their learning, this is included in the indicators of SRL.

Table 6

Indicators and measurement of mental health and SRL across the three manuscripts

	Manuscript 1	Manuscript 2	Manuscript 3
Indicators of Mental Health	Psychological well-being	Psychological well-being	Psychological, social, and emotional well-being using
Measure Used	Adapted version of Rush & Grouzet's (2012) measure	Adapted version of Rush & Grouzet's (2012) measure	Keyes' (2009) Mental Health Continuum-Short Form adapted for weekly use
Indicators of SRL	Academic engagement, goal attainment, main challenge, main strategy	Academic engagement, goal attainment, goal satisfaction, rating of mental health and well-being challenge	Academic engagement, goal attainment, challenge, strategy, mental health strengths and weaknesses
Measure(s) Used	MyPlanner: Online SRL diary tool	MyPlanner: Online SRL diary tool	MyPlanner: Online SRL diary tool, SRL Report: End of semester writing assignment

Overview of Manuscripts

Manuscript 1: Davis, S. K. & Hadwin, A. F. (2019). Exploring differences in psychological well-being and self-regulated learning in university student success. *Manuscript in submission.*

Paper 1 (see Appendix C1) is an empirical study examining psychological well-being (PWB) and self-regulated learning (SRL). This study aimed to examine the interplay between PWB and SRL as students plan for and reflect on their approaches to attaining self-set goals over nine consecutive weeks. There were two research questions. First, does PWB differ between groups of students with varying goal attainment? Second, how do patterns of regulation over the semester differ between a student who consistently attains weekly study goals (i.e., high goal attainment) and a student who does not (i.e., low-moderate goal attainment)? Participants were 118 consenting students enrolled in one semester of a learning-to-learn university course. Students completed a weekly online SRL diary tool, the MyPlanner, in two parts by planning for and reflecting on a single study session. In the planning session, the academic engagement and PWB measures sections in the MyPlanner created an opportunity for students to do an overall check-in on themselves for the previous week before writing a self-set goal. For the academic engagement measure, students answered six questions either yes or no about their engagement in all their academic courses for the past week. The psychological well-being measure was adapted from Rush and Grouzet (2012) and has 10 items where students rated each item on a 6-point Likert scale from 1 not at all to 7 very much. In the reflection, students reported whether they attained their self-set study goal or not, and reported the dominant challenge experienced, and strategy selected to address the challenge.

For RQ1, PWB was significantly correlated to academic engagement ($r = .605$, $p < .001$) and goal attainment ($r = .414$, $p < .001$), and academic engagement was significantly correlated to goal attainment ($r = .538$, $p < 0.001$). Using the histogram of semester goal attainment, we divided students into three groups: (a) low/moderate attainers reporting attaining goals 33-78% of the time ($n = 49$), (b) high attainers reported attaining goals 86-89% of the time ($n = 32$), and (c) always

attainers reported attaining their goals 100% of the time (n = 37). In examining the groups for differences in PWB, overall, the low/moderate goal attainment group had the lowest PWB score of the three groups and was significantly different only from the always goal attainment group. A one-way analysis of variance (ANOVA) determined there were significant differences between the three goal attainment groups for PWB, with the low/moderate goal attainment group differing significantly from the always goal attainment group.

For RQ2, the ANOVA established differences between the PWB of the low/moderate group and the always goal attainment group. We examined within-person patterns of PWB, academic engagement, and SRL for two sample students using process mining to gain insight into regulatory patterns and processes. Student LM from the low/moderate group (mean PWB of 45.22) began the course with high engagement and PWB, but strategy choices led to frequent motivation challenges, leading to moderate engagement and PWB toward the end of the course. Student AL from the always group (mean PWB of 51.89) also began the course with high engagement and PWB, but the strategy choice of persist led to moderate PWB.

The two main findings from this study reveal: (a) students' between-person PWB differs according to self-reported goal attainment, and (b) students' within-person patterns of regulatory responses provide insight into the interplay between PWB and SRL. This study contributes to theory by indicating high PWB may be advantageous for students regulating their learning, or vice versa. When students engage in weekly regulatory planning and reflection, assessing their own PWB and engagement may provide easy access for students to take these data, examine it, and make changes as necessary. Specifically, visualizations of adaptive and maladaptive regulation patterns, such as through process mining maps, may help students identify for themselves where and when to make changes. Finally, analyzing within-person patterns of PWB and SRL processes may offer the most practical opportunity for interventions with high utility and applicability by students to be

successful at university. This study contributed to the dissertation by highlighting the need for between- and within-person analyses.

Manuscript 2: Davis, S. K., Milford, T. M., & MacDonald, S. W. S. (2019). Examining associations over time between psychological well-being, academic engagement, and goal attainment. ***Manuscript in submission.***

Paper 2 (see Appendix C2) is an empirical study examining psychological well-being (PWB) and self-regulated learning (SRL). The purpose of this study was to examine the between- and within-person interplay of PWB and SRL at university. There were three research questions: (1) Between students, how do the process variables of PWB, academic engagement, goal attainment, goal satisfaction, and mental health and well-being challenge predict academic performance in one course and in one semester?; (2) How much variance in weekly PWB scores across a university semester is systematically between- vs. within-person?; and (3) Within students, can coupled-change associations across the semester be clearly demonstrated between PWB and ratings of academic engagement, goal attainment, goal satisfaction, and mental health and well-being challenge?

Consenting participants were 138 students enrolled in an undergraduate elective learning-to-learn course. The data for this study came from the MyPlanner, an online SRL diary tool, completed weekly by students for nine weeks. Variables in this study are divided into two categories: process variables were collected weekly for nine weeks, and academic performance variables were the grades students received for one course, and for the semester. Process variables included PWB and academic engagement from the MyPlanner. The psychological well-being measure was adapted from Rush and Grouzet (2012) and has 10 items where students rate each item on a 7-point Likert scale from 1 not at all to 7 very much. For academic engagement, students answered six yes or no questions about their engagement in all their academic courses for the past week, for example

whether they attended all their classes, submitted all their assignments, or asked for help when needed.

The reflecting variables from the MyPlanner include (a) a goal attainment rating, (b) a goal satisfaction rating, and (c) rating of how much their mental health and well-being was a challenge each week. Similar to the binary response scale used for the academic engagement measure, students made a judgment as to whether they attained their goal with 0 = did not attain the goal and 1 = did attain the goal. Students rated their satisfaction with their goal progress on a 4-point Likert scale, with 0 = not at all, 1 = minimally, 2 = moderately, and 3 = completely. Students rated how much of a challenge their mental health and well-being was on a 6-point Likert scale from 0 = not applicable this week to 5 = negatively affected me this week. For analysis, the scales for these items were reverse coded so that 5 represented "not applicable this week" and 0 represented "negatively affected me this week". The academic performance variables included overall course grade in the learning-to-learn course ranging from 0 to 100 and semester GPA on a nine-point scale.

Analyses in this study used both the within- and between- person analyses. For research question 1, multiple regression was used to predict academic performance from the five process variables. For the within-person analyses used in research questions 2 and 3, multilevel modelling analyses were used because these data are nested as there are repeated measurements (i.e., 9 weekly MyPlanners) nested within individuals (i.e., the students). For RQ1, multiple regression analysis was used to test if the within-person means of the five process variables (i.e., academic engagement, PWB, goal attainment, goal satisfaction, and mental health and well-being challenge) significantly predicted overall course grade and/or semester GPA. The results of the regression predicting semester GPA indicated the five predictors explained 13.2% of the variance in semester GPA (R^2 =.132, F(5,130)=3.963, p = .002), with goal attainment as a significant predictor (β = .247, p = .048). The regression analysis predicting overall course grade was not significant.

For RQ2, calculating the intraclass correlations (ICC) determined the between-person and within-person variance for all variables which ranged from 37% for PWB to 87% for goal attainment. The ICC for PWB determined 63% of the variance in PWB was between-person and 37% was within-person. For RQ3, the coupled-change model with academic engagement accounted for the most variance by accounting for a total of 42% of the within-person variance in PWB over time. The interpretation of the coupled change estimate(γ_{20}) for model 1 indicates on occasions when academic engagement is one unit higher than usual for a given individual, PWB increases by 2.07. Additionally, on occasions when the mental health and well-being challenge rating is one unit higher than usual for a given individual, the coupled change estimate (γ_{20}) for PWB increases by 1.22. The coupled change models with PWB and goal satisfaction and goal attainment were not significant.

The findings from these analyses indicate: (a) the importance of between- and within-person methods in this line of research, (b) the coupled-change models show PWB shifts over time in association with PWB and with mental health and well-being challenge rating, and (c) goal-setting and PWB needs further examination. The findings from this study contribute to theory in highlighting PWB as an internal condition affecting students' learning at a larger-grained (i.e., weekly) level, but not at the finer-grained individual level of goals students aim to attain. Examining within-person patterns over time of mental health and SRL may offer the most opportunity for intervention. Campus based interventions could look at using research-proven SRL strategies and processes to optimize students' mental health in classrooms during learning, to complement existing programs emphasizing mental health literacy and promotion in out of classroom settings. This study contributed to the dissertation by using a unique analytical method (i.e., coupled change models) to examine the interplay of PWB over time with other variables and highlighted the importance of grain size of constructs examined.

Manuscript 3: Davis, S. K., Rostampour, R., Hadwin, A. F., & Rush, J. (2020). The role of mental health in adaptive regulation of learning and student success. ***Manuscript in preparation.***

Paper 3 is an empirical study building on the findings of Papers 1 and 2 by using a case study approach using an extreme case sampling method (see Appendix C3). The purpose of this case study was to examine mental health and adaptive regulation exhibited by two contrasting groups of students (i.e., the high mental health group and the low mental health group) in a university learning-to-learn course. There were three research questions: (1) What challenges do students in each group report strategically addressing during study sessions?; (2) What adaptive and maladaptive regulatory paths are engaged by students during study sessions?; and, (3) How do students in each group interpret their mental health collected during weekly study sessions over the course of a semester?

Participants were 229 consenting students enrolled in two semesters of an undergraduate elective learning-to-learn course out of which 49 students (21%) were identified as belonging to either the high or the low mental health groups due to having consistently high or consistently low mental health during the semester. Extreme case sampling (Miles et al. 2014) was used to identify two maximally contrasting groups in terms of the overall mental health and well-being scores. Students who scored higher than 1 SD from the weekly means were identified as members of the high mental health group for that week and those who scored one SD below the weekly means were identified as being members of the low mental health group for that week. Finally, cases were narrowed down to students who were identified as member of the high (n = 27) or the low (n = 22) group at least half of the weeks (i.e., 5 out of 10 weeks).

Data were collected through two tools students completed in the course: the online SRL diary tool (i.e., the MyPlanner) and the SRL Report. The diary tool was completed weekly for 10 weeks and variables examined in this study were completed in the planning and reflecting parts of

the tool. In the planning section, we measured mental health and academic engagement. For mental health, we used Keyes' (2009) 14 item Mental Health Continuum—Short Form that measures psychological, social, and emotional well-being. Students rated each item on a 5-point Likert scale from 1-Never to 5-Every day. For academic engagement, students responded to six yes or no questions about their engagement in all their academic courses for the past week. In the reflecting part of the online SRL diary tool, the variables were challenges, strategies, and goal attainment. Students reported whether they attained their self-set study goal or not, and reported the dominant challenge they experienced, as well as the strategy selected to address the challenge. The SRL report was the major writing assignment for the course, worth 15% of the overall mark. Students were guided through four questions where they evaluated their strengths and weaknesses in the four areas, identified one target for change about their learning, made a strategic plan to change, and described how they will self-monitor their plan.

For RQ1, we analyzed (a) the challenges students encountered, (b) the strategies they adopted to tackle such challenges, and (c) whether their strategy choices led to goal attainment. The distribution of challenges students encountered across two groups were relatively similar, with motivation and goal and planning challenges being highest risk challenges both in terms of frequency and failure rates. When these two challenges were faced, 33% and 57% of the goal events were not met respectively in the high and the low group. However, all the instances where mental health was reported as a challenge by students in the high group were successfully tackled by their strategy choices while 25% of the same events in the low group led to goal failure. For strategies, students in both groups tend to adopt riskier strategies (i.e., riskier in terms of leading to failure of goal attainment) such as passive and persist in response to the motivation challenge than more effective ones such as task understanding, changing effort, and emotion regulation, that were underused yet reported as highly effective for addressing motivation challenge.

For RQ2, we were interested to see if a within-person analysis could reveal any differences in regulatory patterns across the two groups. For this purpose, we analyzed students' tendency to retry a maladaptive path. A maladaptive path is a combination of a challenge a person encountered and a strategy they adopted that has once led to goal failure (ChallengeX→StrategyY→Did Not meet one's goal). In response to the motivation challenge, about, 3.7 percent of members of the high group retried a maladaptive path once more on average while about 18 percent of members of the low group tried such a maladaptive path 1.5 times more on average.

For RQ3, we used qualitative data from the first two questions of the SRL Report where students had to evaluate their strengths and weaknesses and identify one target for change about their learning. We used causation coding to analyse why students describe their mental health as a strength or weakness based on their data by searching their writing for causes, conditions, contexts, and/or consequences. The low mental health group (a) identified more weaknesses for their mental health than strengths, and (b) listed SRL processes and strategies as helpful for better mental health. The high mental health group (a) identified more strengths for their mental health than weaknesses, and (b) highlighted the role of social well-being in having better mental health.

The findings from these analyses can be summarized in two themes: (a) students with higher mental health showed more adaptive regulation of learning, and (b) metacognitive awareness around mental health may foster student success. From this study, a theoretical contribution is that mental health is not only a condition, but also a product that may affect engagement with any of the 4 phases of the Winne and Hadwin (1998) SRL model. Previous research has proven Keyes' theory of mental illness and mental health as separate yet related constructs (Keyes, 2003), but we do not know how students' beliefs around their mental health affect their learning at university. This could be a potential barrier to future research on mental health and thus including mental health literacy to students is essential to ensure they have accurate, up-to-date knowledge. Findings from this study suggests two metacognitive interventions (i.e., weekly online SRL diary tool, SRL Report) guiding

students through collecting, analyzing, and taking action around their learning data are useful when they include mental health. This study contributed to the dissertation by (a) highlighting differences in SRL between the two groups, and (b) revealing the value of metacognitive interventions, such as the MyPlanner and SRL Report, for all students regardless of their mental health.

Chapter 4: Discussion

This dissertation aimed to contribute to the field by examining mental health and SRL at university. First, mental health and SRL have not been examined as dynamic processes developing over time in the limited body of research to date. Thus, the first aim of this dissertation was *to examine the interplay between self-regulated learning and mental health in student success at university*. Next, by situating research during learning and highlighting the role of metacognitive interventions in understanding the role of mental health in SRL, this dissertation provides insight into these processes and implications for researchers, educators, and students. The second aim of this dissertation was *to explore a variety of methods and analyses examining between- and within-person differences in this interplay*. Within each aim, main findings are summarized from the three manuscripts with implications for theory, research, and practice addressed within each section. Figure 1 displays the main findings for each aim and references the papers that contribute to these findings.

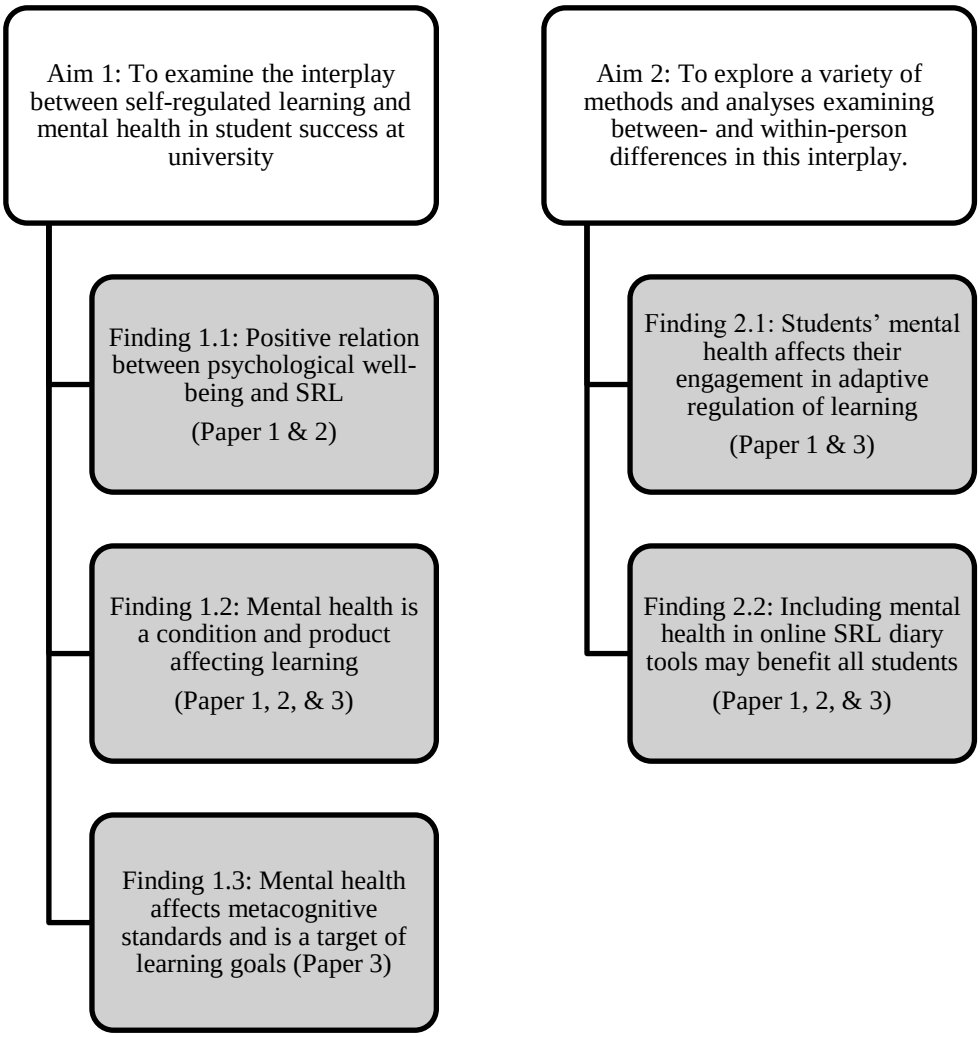

Figure 3. Summary of findings across the three papers in the dissertation

Aim 1: The Interplay between Self-Regulated Learning and Mental Health

Previous research has indicated students with higher mental health also engage in more adaptive regulatory behaviours and have higher self-reported grades (e.g., Grunschel et al., 2016; Howell, 2009). However, little is known about the interplay between self-regulated learning (SRL) and mental health. Thus, all three papers addressed the first aim of this dissertation, with three main findings to highlight: (a) there is a positive relation between psychological well-being (PWB) and SRL, (b) mental health is a condition and product affecting learning, and (c) mental health affects metacognitive standards and goal-setting.

Finding 1.1: Positive Relation between Psychological Well-Being and SRL

In the design of this dissertation research, students who were enrolled in a learning-to-learn course were chosen for this research as it was expected they would exercise more variance in their SRL processes and strategies because they were being prompted to try new studying approaches and strategies (see Winne, 2014). Further, previous research has established potential overlap between PWB and SRL (see Howell, 2009), thus warranting a closer examination. In two manuscripts in this dissertation (Paper 1 and Paper 2), positive relations were established between PWB and academic engagement, goal attainment, goal satisfaction, semester academic performance, and rating of mental health challenge. Students completed weekly online SRL diary tools to plan for and reflect on a 1-2 hour study session. At the beginning of the tool, students were invited to reflect on their PWB and academic engagement by rating their experiences on a series of items. This was followed by setting a goal for a 1-2 hour study session. After the study session, students reflected by reporting their goal attainment, goal satisfaction, and challenges experienced. Future research could examine if interventions to support active monitoring and regulating of PWB promote better mental health outcomes. For example, if students prioritize their PWB or mental health, do they also report more engagement in adaptive regulation? Do students who report more adaptive regulation also report a higher PWB or mental health?

In Paper 2, PWB and academic engagement, goal satisfaction, and rating of mental health challenge had moderate, positive correlations, whereas PWB and goal attainment exhibited a weak, positive correlation. Thus, students with higher PWB had higher academic engagement, were more satisfied with their goals, rated mental health challenges as less of a problem, and also attained more of their goals, compared to students with lower PWB. Importantly, this does not indicate that high PWB causes high engagement with SRL processes and strategies or vice versa as correlation does not equal causation; this complex, multidimensional interplay is dynamic. It does however, indicate, PWB and SRL processes may be more closely related than the other two factors of mental

health (i.e., emotional and social well-being) and future research could examine this relation further as this dissertation did not. In addition, as many of these variables had high within-person variance, different methods and analyses were used in this dissertation with the aim of further unpacking this variance.

Finding 1.2: Mental Health is a Condition and Product

Findings from Paper 1 (Davis & Hadwin, 2019), Paper 2 (Davis et al., 2019), and Paper 3 (Davis et al., 2020) confirm the hypothesis stated earlier in this dissertation that mental health is an internal condition influencing SRL. Paper 3 indicates mental health may also be a product. The COPES architecture describes the micro-level interactions occurring within and across the four macro-level phases of SRL: conditions, operations, products, evaluations, and standards (Winne & Hadwin, 1998). *Conditions* can be internal or external or about oneself, whereas *products* are the information or new knowledge created by the operations.

In Paper 1, students from one semester of the learning-to-learn course were separated into three groups based on their self-reported semester goal attainment. Students who reported attaining all their self-set study goals had higher PWB than students who reported attaining only some of their goals (i.e., <78%). This suggests an association between PWB and goal attainment in SRL. Thus, PWB as a condition, affects goals in the second phase of SRL. Students who reported attaining all their goals had higher PWB than students who attained less goals. This suggests that higher PWB can act as a condition facilitating or hindering goal attainment. However, students often pursue many goals simultaneously and these goals can be congruent or incongruent with each other (Boekaerts & Niemivirta, 2000). For example, a student may set a goal to review for an upcoming exam so they have a better understanding of course concepts. The same student may hold a simultaneous goal of completing this study session as quickly as possible so they can spend time with friends. Thus, the grain-size and type of goal may be important when considering PWB as a condition affecting goal attainment.

The finding of mental health as a condition was also examined further in Paper 2 by using coupled change models. Paper 2 found students' weekly PWB was positively associated over time with academic engagement and rating of mental health and well-being challenge but was not associated with goal attainment or satisfaction. One possibility is that PWB is a condition that affects students' goal-setting at a larger-grained, or weekly, level rather than the finer-grained self-set goals examined in this study. Previous research has determined goal attainment for larger-grained semester goals (e.g., get a high overall GPA) are associated with higher well-being (see Sheldon & Elliot, 1999). Thus, future research could examine mental health and study goals at a similar grain level in order to determine their association, such as through daily experience sampling.

Finally, Paper 3 considered mental health as a condition in order to identify extreme cases to examine differences between students with consistently high mental health and consistently low mental health during a semester. Findings from this study reveal students from the two groups engaged in different regulatory behaviours, especially around mental health challenges. Students in the high mental health group reported employing a wider variety of strategies and always attaining their goal when they experienced a mental health challenge. In contrast, students in the low mental health group adopted passive strategies and only attained their goal 25% of the time they reported a mental health challenge. Future research is needed to examine the role of mental health as a condition during learning. In particular, this dissertation only examined the goal-setting phase of SRL. Thus, examining how mental health particularly affects students' task perceptions at university would ensure students' monitoring and evaluating is targeting the most commonly overlooked aspect of SRL in university learning. This would be especially important to understand how students' perceptions of tasks change in the transition from secondary to postsecondary environments and how mental health is affected, or vice versa.

In addition, there are indications from the findings of Paper 3 that mental health is also a product of learning, particularly for students with lower mental health. In the SRL Report (i.e., end of semester writing assignment), students were asked to write about their strengths and weaknesses for their engagement, mental health, goals, and challenges. The responses about mental health were coded using causation coding to determine antecedents, causes, and outcomes. This coding found both students in the low mental health group and in the high mental health group described mental health as a product. Students in the low mental health group listed the following reasons contributing to their low mental health: academics (e.g., academic stress, heavy course load, low motivation), socioemotional issues (e.g., poor health, social distractions, lonely), and career uncertainty. Students in the high mental health group listed fewer reasons for their lower mental health: low social and/or emotional well-being, lack of interest, mental health fluctuations, and many deadlines. This finding suggests myriad reasons why students may have lower mental health as a product of their learning. In particular, students with lower mental health made the connection between their learning and their mental health as a product more explicit compared to students with higher mental health. This finding was also echoed when students described mental health as a positive outcome of their learning.

When mental health was described as a positive outcome by students in the low group, they explicitly identified SRL processes and strategies as causing higher mental health. Examples include metacognition, stress management, adjust strategies, exam studying, and goal management. Students with higher mental health, on the other hand, only described goal-setting and confidence as contributing to their higher mental health. Other reasons they described were physical health, effective stress management strategies, and high mental health. Both groups of students received the same instructions and used their own information from their weekly MyPlanners to draw these conclusions. Also, students were not specifically asked to describe SRL strategies and processes as reasons for strengths and weaknesses in their mental health. Mental health as a product, therefore, is

evidenced by students' recognition that SRL processes used during operations (i.e., in the COPES architecture) produce information about their mental health. Products comprise a range of attributes beyond just cognition, and Paper 3 indicates mental health may be a product. Future research should examine how mental health as a condition and product affect engagement in SRL, and even the operations, evaluations, and standards. The next finding from this dissertation may provide some indications as to how standards are affected by mental health.

Finding 1.3: Mental Health Affects Metacognitive Standards and Is a Target of Learning Goals

If mental health is a condition, then it may influence the phases of SRL similarly to motivation and emotion. Winne (2018) outlines how motivational and emotional states influence all phases of SRL and automatically affect learning in three areas: task perceptions, standards used in metacognitive monitoring, and learning goal targets. Based on the findings in this dissertation, I posit mental health, as an internal condition, can affect standards used in metacognitive monitoring and be the targets of learning goals.

Standards During Metacognitive Monitoring

Findings from this dissertation indicate that mental health and standards during monitoring may have their own interplay. From Flavell's (1979) model, monitoring occurs through the interactions between metacognitive knowledge and experiences, goals/tasks, and actions/strategies. Mental health, much like level of emotions or motivation during learning, may influence standards for learning and monitoring. (Winne, 2018, p. 40). In the COPES architecture, standards provide the criteria students need so they can monitor the products produced (Winne & Hadwin, 2008).

Findings from Paper 1 and Paper 3 revealed students with lower goal attainment had lower mental health or PWB, compared to students with high goal attainment. This indicates there may be differences in students' standards during learning depending on their mental health. There are three possible explanations for a difference in standards due to mental health. First, students with lower

mental health may not be integrating their metacognitive experiences to their metacognitive knowledge as easily as students with higher mental health. Second, students with lower mental health may find it difficult to judge whether their work fits the criteria of their standards. Finally, students with lower mental health may be unclear on their standards if the condition of their lower mental health is affecting their engagement in SRL processes.

In addition, mental health as a condition affecting learning could affect students' standards for their metacognitive monitoring. However, because directionality was not determined, the converse may also be true: poor metacognitive awareness may lead to mental health challenges in postsecondary education. From examining the process mining maps in Paper 1, the student who had lower PWB also chose less effective strategies to address challenges (e.g., passive strategies) and had lower goal attainment. The student with higher PWB chose more effective strategies to address challenges (e.g., emotion regulation, goal management) and had higher goal attainment. This could indicate the interaction between metacognitive knowledge and experiences is different for students with varying levels of mental health. Future research should examine specific standards students set for tasks to determine if varying levels of mental health result in students setting lower or higher standards for their learning.

Next, for students with lower goal attainment (i.e., Paper 1 and 2), there may be myriad reasons why students did not attain their goal. From an SRL perspective, it could be due to poor metacognitive monitoring and evaluating at any of the four SRL phases, for example that the goal was too challenging and the student did not monitor their level of challenge effectively. Or perhaps, they did monitor their lack of goal attainment and chose to not change their behaviour or address this challenge (e.g., by doing nothing, a passive strategy). Regardless, the product (e.g., the goal attainment attempt) was negatively affected. The fact that students with lower mental health also had lower goal attainment confirms mental health as both a condition and product with potential to

affect the macro processes of SRL (i.e., task perceptions, goal-setting, task enactment, large scale adaptation).

Finally, for students with higher mental health, there are also some inconsistencies in their metacognitive monitoring. From Paper 1, students in the always goal attainment group reported always attaining their self-set study goals during a semester. Additionally, around 40% of students in the high mental health group in Paper 3 reported always attaining their goals. There could be several explanations for why students with high mental health had high goal attainment. Perhaps these students set goals that are too easy, and their metacognitive standards were too low. Students with better mental health may (a) strategically set easier goals to build confidence or to set a goal for a study session they perceive to be realistic, and (b) end up engaging in more complex cognitive operations during the study session. If students with higher mental health were keeping track of the complexity and/or difficulty of their goals to help them increase standards based on previous goal attainment, they may be able to increase their academic performance through a scaffolded metacognitive intervention, such as an online SRL diary tool. Therefore, future research would benefit from examining how students with low and high mental health engage in metacognitive monitoring around standards for self-set study goals and how metacognitive interventions can be effectively tailored to the needs of these students.

Target of Learning Goals

Students set goals to regulate their motivation and/or emotions during SRL (Winne, 2018); findings from this dissertation also suggest students set learning goals to target their mental health. From the SRL perspective, this is important because it acknowledges the potential for intentionally monitoring and controlling (i.e., regulating) mental health, much like students regulate cognition or behaviour. This indicates students may use metacognitive monitoring and evaluating to determine when to set goals for their mental health and not just their academic progress and success.

In Paper 3, students completed the SRL Report at the end of the semester based on data collected in the weekly online SRL diary tools. Nine of the 22 students with lower mental health identified mental health as a target for their SRL Report assignment compared to only four out of 27 students in the high mental health group. This target then functioned as the goal to complete the rest of the assignment. However, in analyzing students' MyPlanner data, students in both groups reported experiencing the same amount of mental health challenges during the semester (i.e., around 8% of all challenges reported by both groups), suggesting students in the high mental health group may benefit from targeting mental health during learning as well. What remains unknown is how students target mental health during finer-grained learning goals, such as the ones for a 1-2 hour study session in the online SRL diary tool.

In sum, combined with the previous findings of this dissertation that mental health also influences standards during metacognitive monitoring, future research could further examine students' metacognitive awareness *about* their mental health. For example, when do students determine they need to target their mental health in a learning goal? How do students know if their mental health is hindering their success? How do students' metacognitive knowledge and experiences inform this decision making when their mental health is low? Prompting metacognitive awareness of students' mental health during learning highlights the importance of mental health in SRL.

Aim 2: Methods and Analyses Examining Between- and Within-Person Differences

Previous research on mental health and SRL has relied on instruments given at one time point, underemphasizing the dynamic natures of these two processes. Further, many existing studies have relied on between-person analyses (e.g., Peter et al., 2011), rather than also examining how within-person analyses could reveal associations over time between mental health and SRL at university. Two main findings from the manuscripts in this dissertation indicate (a) students' mental

health affects their engagement in adaptive regulation of learning, and (b) including mental health in online SRL diary tools may benefit all students.

Finding 2.1: Students' Mental Health Affects their Engagement in Adaptive Regulation of Learning

Adaptive regulation of learning occurs when students choose effective strategies for challenges they experience during the process of trying to attain self-set goals. Maladaptive regulation occurs when, for a second time, students choose a strategy for a challenge when this strategy-challenge combination has already resulted in a failure to attain the goal. In Paper 1, examining two process mining maps (i.e., from one student who always attained their goals and one student who sometimes attained their goals) showed different patterns in the students' maps. The student who always attained their goals did not have any maladaptive regulatory patterns; this student chose a variety of strategies with which to tackle challenges. The student who sometimes attained their goals struggled to engage in adaptive regulation particularly with motivation challenges; twice this student used a passive strategy (i.e., did nothing, avoided the task) which led to not attaining the goal. The always goal attainment student started off the semester with higher PWB and academic engagement and ended the semester with similar levels. Conversely, the student who sometimes attained their goal also began the course with higher PWB and academic engagement but ended the semester with moderate levels of both PWB and engagement, suggesting continued maladaptive regulatory patterns over time may affect academic engagement and/or PWB.

Paper 3 built upon this finding by comparing regulatory paths between the two groups of students: the low mental health group and the high mental health (MH) group. For all challenges reported by students during the semester, 7% of the students in the high MH group retried a maladaptive path compared to 23% of the students in the low MH group. For motivation challenges (i.e., the most common challenge experienced by both groups), 4% of the high MH group students retried a maladaptive path compared to 18% of the students in the low group. This indicates

students in the low MH group may not be optimizing the feedback from their metacognitive monitoring of their goal progress compared to students in the high MH group. Students in the low MH group may not be metacognitively aware of their learning patterns across events, or these students may be aware but not know how to intervene and stop the cycle. In other words, students in the low MH group may not be able to connect their metacognitive experiences to their metacognitive knowledge and may need more explicit instruction as to how to use metacognition to regulate their strategy selection around challenges.

However, these findings provide evidence that these types of challenge-strategy-goal attainment sequences, paired with academic engagement and/or mental health, are potential candidates for visualizations to be provided to students, in order to determine why students with low MH try maladaptive paths more often than students with higher MH. This provides a larger practical aim of helping students monitor their own learning and their mental health. Students may benefit from visualizations of these regulatory paths to (a) help students see the challenges and strategies they report using, (b) how their mental health and/or academic engagement may be implicated in this process, and (c) identify when maladaptive regulatory paths are occurring and need intervening. Students may engage in maladaptive regulatory paths on purpose or not and this could be due to any number or reasons, for example self-efficacy, resilience, motivation, or any other condition. In addition, students with weak metacognitive awareness or self-regulatory competencies may be more likely to experience languishing mental health during university. Thus, future research should explore how students' internal conditions (i.e., mental health) may affect adaptive regulation and how to present this feedback to students and best support their interpretation of the data (e.g., with a reflection activity, discussion of their maps) so students can take action to optimize their success.

Finding 2.2: Including Mental Health in Online SRL Diary Tools May Benefit All Students

Findings from across all three papers in this dissertation support using metacognitive interventions, such as the online SRL diary tool, with all students regardless of their mental health. This supports theory as Keyes' (2005) dual-continua model of mental health states everyone has mental health all the time; thus, metacognitive interventions have utility for all students, not just students with poor mental health. This dissertation used two metacognitive interventions: the MyPlanner (i.e., the online SRL diary tool), and the SRL Report. The MyPlanner, completed weekly, prompts students to answer a series of metacognitive questions about their plan to take control of one study session to attain a goal, and then reflect on the goal attainment process. The SRL Report is completed at the end of the semester and required students to collect their MyPlanner data and answer a series of questions about their strengths and weaknesses, identify one target for change, create a plan, and evaluate that plan. These interventions (a) encourage students to take an active role in their learning by prompting metacognitive monitoring and awareness, and (b) support the finer-grained definition of student success as when students attain self-set goals, as the goals students use in these interventions are based on their judgments and evaluations of their values and priorities as learners.

Three findings from the papers in this dissertation support the use of metacognitive interventions targeting mental health for all learners. First, Paper 3 revealed that regardless of mental health, students experience consistent levels of mental health challenges affecting their goal attainment process. Of all the challenges students experienced, 7% of the challenges self-reported by the high mental health group were mental health challenges, compared to 8% for the low mental health group. These students did respond differently to addressing these challenges: students in the high mental health group attained their goal 100% of the time they had a mental health challenge, whereas students in the low mental health group attained their goal only 25% of the time. This finding indicates the differences in attainment are potentially occurring during the task enactment

phase of SRL after recognizing a mental health challenge: students with higher mental health choose more effective strategies such as help-seeking, whereas students with lower mental health choose less effective strategies, such as avoiding the task. For motivation challenges, low MH group students used passive strategies 60% of the time compared to high MH group students using passive strategies only 17% of the time. However, for goal setting and planning challenges, both groups of students used passive strategies that resulted in failing to attain their goal. Future research should examine differences in strategy selection for mental health challenges, and other common challenges (e.g., motivation, goal and planning) by students with different levels of mental health.

Next, in Paper 3, students from both groups identified mental health as a target for their SRL Report assignment (i.e., 9 out of 21 (42%) students in the low mental health group compared to 4 out of 27 (15%) students in the high mental health group). Even though 4 of these students were identified as belonging to the high mental health group, these students still wanted to target their mental health in the SRL Report. This brings up an important issue for future research: calibrating students' perceptions of their mental health with their measured mental health. Many previous studies on university students' mental health does not address if students had access to their results on the measures (e.g., Howell, 2009). This dissertation used mental health measures where students had access to their mental health data, and in Paper 3, students reviewed their mental health data to identify strengths and weaknesses. Thus, an important consideration is how to guide students through interpreting their mental health data and whether students' perceptions of their mental health matches their results on the measures. This may also require including a mental health literacy component so that when students are engaging in reflecting on their mental health, they have access to not only accurate information but also available resources on campus and/or in the community.

Finally, students in both groups provided myriad reasons as to why they had higher or lower mental health (Paper 3). Students in both groups reported (a) high psychological well-being and

social well-being as antecedents, and (b) high social well-being and emotional well-being, and goal-setting as causes for higher mental health. In addition, students in both groups reported low social well-being and low emotional well-being and a heavy course load as mediating causes for lower mental health. Students in the high mental health group were able to list more reasons for their high mental health, and students in the low mental health group were able to list more reasons for their low mental health. Interestingly, only low group students listed SRL strategies and processes as beneficial for their mental health. However, both groups of students exhibited faulty beliefs about mental health: low group students listed having a mental illness as reason why they could not have better mental health and high group students listed their high mental health as a stable trait, for example it was an integral part of their personality. Using qualitative approaches, such as in Paper 3, provides promising avenues for future research. These approaches provide opportunities for students' voices and experiences to guide future research to complement current theoretical or data-driven approaches.

These findings highlight two potential targets for augmenting metacognitive interventions such as the SRL Report. First, students with higher mental health may benefit from questions prompting elaboration about their mental health and how SRL strategies and/or processes are implicated. Fluctuations in mental health are normal (Keyes, 2005); therefore, students with higher mental health should expect to experience a change in their mental health during a semester or an academic year. This dissertation did not examine these fluctuations, but future research could examine how students' mental health fluctuations affect their learning. Further, by clearly linking how students take control of their learning through SRL, students may be able to incorporate these successful practices in the future, when their mental health fluctuates. Second, students with lower mental health were able to connect using SRL strategies and processes as beneficial to their mental health. Having students reflect on their progress earlier in the semester may help students identify when their mental health is negatively affecting their learning. Therefore, future research could

examine if having students collect, analyze, and evaluate their learning and mental health data earlier in the semester and at the end of the semester effects change in students' metacognitive knowledge and experiences around their mental health, learning, and success at university. In addition, examining if all three factors of mental health fluctuate at the same rates either weekly or monthly could help inform how and when to measure mental health during a semester.

Limitations

In synthesizing the findings across the papers in this dissertation, four limitations are evident: (a) these papers adopted an exploratory approach, (b) the inconsistency around the term mental health, (c) the limitations of defining mental health through Keyes' (2005) conceptualization, and (d) the limited generalizability of these studies.

Exploratory Approach of the Dissertation

The exploratory nature of these studies also resulted in targeting finer-grained processes of SRL (e.g., goal-setting, main challenge, strategy used) rather than interactions between mental health and other aspects of SRL (e.g., motivation, emotion, cognition). In addition, in hypothesizing there is an interplay over time between mental health and SRL, traditional outcome measures of academic performance (e.g., GPA, grades) were considered as secondary analyses, because the focus was on examining processes of mental health and SRL together. Comparing grades revealed there were no differences in weekly or semester grades whether students were grouped by goal attainment (i.e., Paper 1) or mental health (i.e., Paper 3). This may suggest some other factor could be mediating or moderating the relation between mental health and academic performance. In sum, the exploratory approaches used in this provide indications where future research could elaborate on the interplay between SRL and mental health.

Inconsistencies in Defining Mental Health

Another limitation was the challenge in locating studies on SRL and mental health due to the inconsistency of language around the term "mental health". Future research on mental health and SRL would benefit from a review of terms referring to mental health (e.g., well-being, psychological well-being, academic well-being, anxiety, depression). In the field of SRL, Dinsmore et al.'s (2008) meta-analysis compared metacognition, self-regulation, and self-regulated learning as these three often appear in the literature as interchangeable terms. This meta-analysis has led to better consistency in terminology in SRL research and a comparable review of mental health terms could do the same. In addition, as mentioned in Chapter 1 of this dissertation, there are studies examining broad aptitude-based measures of SRL and symptoms of mental disorders, such as anxiety and depression, however these studies often define mental health as symptoms of a mental illness. This inconsistency of terms may have resulted in certain studies not being referenced in this dissertation, especially if no clear definition of well-being was given. For example, in Boekaerts' (2006) SRL model, well-being is used to describe one of the pathways, but no definition of well-being is given.

Limitations of Keyes' Conceptualization of Mental Health

This dissertation has established directions for future research on mental health and SRL using Keyes' (2005) conceptualization of mental health. However, this is only one perspective on mental health. This Western framework on mental health has been confirmed and validated in countries around the world, but it cannot be viewed as culture-free. Christopher (1999) posits no theory or measure can be considered as equally applicable to all cultures. An example of another mental health conceptualization that is culturally-specific is the First Nations Mental Wellness Continuum Framework (Thunderbird Partnership Foundation, Health Canada, 2015), This framework defines wellness as hope, belonging, meaning, and purpose. In addition, the intersectionality of mental health with race, gender, age, social class, and/or disability status is not addressed in this dissertation. Intersectionality, a term first used by Crenshaw (1989), is receiving

increasing attention in psychological research. Intersectionality emphasizes the importance of "attending to multiple, intersecting identities and ascribed social positions along with associated power dynamics, as people are at the same time members of many different social groups and have unique experiences with privilege and disadvantage because of those intersections" (Rosenthal, 2016, p. 475). This dissertation focused on the interplay between mental health and SRL processes in students and did not include considerations of the intersectionality of mental health with social positions. However, continued investigations as to the intersectionality of mental health and how it affects students' engagement with SRL will make salient contributions to the literature.

The Mental Health Continuum-Short Form (MHC-SF; Keyes, 2009) was the main measure used to measure mental health. Previous research confirmed the three-factor structure of the MHC-SF (see Keyes, 2009). However, in Paper 3 of this dissertation, the time period of the measure was changed from monthly to weekly. In measuring daily well-being and examining within-person associations (i.e., through daily experience sampling), eight measurement bursts are common in the literature (Rush, 2018). The approach was used in this dissertation was to have students complete the online SRL diary tool weekly during a semester, and to use the original instructions from the measure as to how to interpret scores. However, Kapil (2020) found that the original three-factor fit (i.e., psychological, emotional, and social well-being) was poor in using the MHC-SF on a weekly basis and suggests a reworking of the scale to a better three-factor fit. Therefore, the categorization of students as flourishing and languishing may need to be reconfigured to consider these new findings.

Future research on mental health and SRL should clearly define what mental health is in order to contribute to this slim body of work. Conceptualizations of mental health have progressed significantly in the past decade and hopefully future research can remedy this confusion of terms relating to mental health to create consistency in research. This unification will potentially have significant effects in improving student success at university if mental health is rooted in theory and

empirical research. Finally, determining the best fit temporally of measuring mental health in SRL research is needed. Does mental health need to be measured every week? Do all three factors of mental health (i.e., psychological, social, and emotional well-being) need to be measured every week? Determining when to measure mental health also has the potential to contribute significantly to research on mental health and SRL.

Generalizability

Finally, using a case study approach (i.e., Paper 1 and Paper 3) has limitations for generalizability due to small sample sizes. This resulted in more descriptive statistics being compared rather than testing for significant differences. This was because both SRL and mental health were measured at multiple time points over a semester, and these descriptive statistics helped highlight certain areas to examine further. In Paper 3, students were grouped based on self-reports of consistently low or high mental health during a semester. However, fluctuations in mental health are normal (Keyes, 2005) and grouping students based on their fluctuations could be examined in future research. For this dissertation, grouping students together by consistently low or high self-reports of mental health afforded opportunities to examine similarities and differences in SRL. The use of qualitative methods limits the generalizability to other students but provides salient information for understanding how students interpret their mental health and its sources during academic studies. The diverse reasons students listed for their higher or lower mental health reveal the value of qualitative approaches. Future qualitative studies could provide researchers with important insights as to how students perceive their mental health is affected by their learning or vice versa.

Future Directions

The research in this dissertation furthered the underexamined line of inquiry on the interplay between SRL and mental health at university through a variety of methods and analyses. The main findings from this dissertation provide two directions for future research: (a) considering mental

health, SRL, and student success as a heuristic process, and (b) situating mental health within metacognitive SRL interventions.

Mental Health, SRL, and Student Success: A Heuristic Process

A plethora of research has highlighted the rising prevalence of risks to mental health on campuses around the world (e.g., ACHA, 2018; National Union of Students, 2015; Wakeford, 2017), indicating interventions are urgently needed. This dissertation established a connection between reported mental health experiences and SRL behaviours. Further, it demonstrates that students may benefit from monitoring their mental health during learning at university regardless of academic performance scores or mental health functioning. At the centre of SRL is the learner; self-regulating learners actively take control of their own learning, affect, motivation, and behaviors while pursuing their own learning goals (e.g., Schunk & Greene, 2018). This indicates providing students with the knowledge and strategies they need to optimize their learning *and* their mental health is a future direction for both research and practice. When researchers and educators consider SRL studies as offering heuristics for practice instead of absolute rules (Winne, 2018, p. 45), this future direction is best served.

Rather than considering the interplay between SRL and mental health as a causal dilemma, I posit this interplay is a heuristic process fueled by metacognition. For example, examining this interplay as a causal dilemma would have sought to answer whether SRL predicts mental health or if mental health predicts SRL. A heuristic is defined as "involving or serving as an aid to learning, discovery, or problem-solving by experimental and especially trial-and-error methods" ("Heuristic", n.d.). Therefore, a heuristic process would be one in which students are encouraged to take an active role in their learning, experiment with new methods, and/or consider feedback about their learning. This type of approach to learning has already been highlighted as essential to learning to SRL (e.g., Winne, 2014).

In addition, this dissertation conceptualizes SRL according to the four recursive, loosely sequenced macro-phases of SRL (i.e., task perceptions, goal-setting, strategic enactment, large-scale adaptation) and the cognitive architecture of COPES as experienced during an academic task outlined in Winne and Hadwin's (1998) SRL model. This model certainly addresses all the facets of SRL (i.e., cognition, behaviour, motivation, emotion, and now, mental health) and how they are implicated in the micro- and macro-levels of SRL. What this model does not establish, however, is the causal relation between these facets and the levels of SRL. Instead, this model (a) recognizes individual differences are implicated in how students plan for a task, enact strategies, adapt their approaches, and metacognitively monitor and evaluate their learning; and, (b) aids students by directing them through phases beneficial for their learning approaches, specifically metacognitive monitoring and evaluating.

Considering SRL and mental health to be a heuristic process for learners is also supported by Winne's (2017) article that outlines why identifying causal factors to account for improvement in learning should be interpreted with caution. Winne argues randomized-control trials (a) emphasize the group level mean of change making it challenging to provide recommendations to individual learners and (b) oversimplify the effect of moderators as they are usually tested one-at-time. Further, "a particular learner stands on very, very soft ground when predicting what will happen if a treatment is adopted or experienced when studying different content under different conditions (Winne, 2017, p. 8). This is not to say there is not empirical importance in modelling complex learning processes over time, such as through multi-level modelling or structural equation modelling. But, if we consider SRL as a heuristic process, implications derived from these types of analyses will be limited.

However, for SRL and mental health, the findings from this dissertation support existing evidence that mental health is subjective (e.g., Keyes, 2005), and thus mental health is a subjective experience during learning. Any modelling done with SRL processes and mental health such as in

this dissertation (e.g., goal attainment, academic engagement) should recognize these limitations. In particular, what are the practical implications for students of a causal or predictive model? For example, if an analysis determines high mental health causes higher goal attainment, do we tell students to increase their mental health before trying to attain a goal? How would students increase their mental health? This is because mental health and SRL, especially when conceptualized using Winne and Hadwin's (1998) model, combine to form a dynamic interplay with over-time fluctuations at risk of being oversimplified and reductionist when not viewed as a heuristic process.

Finally, this view of the interplay as a heuristic process is supported by defining student success as when students aim to attain self-set goals. This fine-grained definition recognizes students (a) are agentic individuals with the potential to make changes to their learning approaches at any time, and (b) hold and manage myriad short- and long-term goals related to their success. This dissertation only addressed a few pieces of the puzzle of student success in examining the interplay of aspects of SRL and mental health. Future research would benefit from situating learners at the centre of this line of inquiry; qualitative data in this dissertation were rich sources of information on how students viewed their own mental health. These insights were due to guiding students' metacognition about their mental health and learning. Thus, metacognitive awareness is an important commonality and fuel in this interplay. Therefore, having students include mental health as something for them to monitor during learning, may provide more insight as to this complex system, particularly for students themselves.

Situating Mental Health within Metacognitive Interventions

Metacognitive interventions are useful for students because they have the potential to facilitate the transfer of information between metacognitive knowledge and experiences. They also provide opportunities for students to reflect on their learning experiments by analyzing event-based learning episodes. Findings from this dissertation revealed students' faulty beliefs about their mental health may affect their progress toward goals and/or tasks. For example, students may have

inaccurate metacognitive knowledge around their mental health if they believe their mental health is a stable trait and will never change. For example, students with higher mental health in Paper 3 attributed their consistently high mental health to their personality. This may be similar to the stability bias in memory as identified by Kornell and Bjork (2009). Students who have a stability bias believe they will always remember previously learned information, underestimating the fallibility of human memory. Some students may also hold a similar stability bias about their mental health. In particular, students with high mental health may believe their mental health will always be high. Thus, students' metacognitive knowledge around their mental health may need to be augmented with a mental health literacy component to increase their knowledge about mental health, especially that fluctuations are normal.

Further, students' metacognitive experiences, such as how students move through the Winne and Hadwin (1998) phases of SRL may be hampered by poor mental health. Students' task perceptions, goal-setting, strategic enactment, and/or large-scale adaptation may be influenced by their mental health. Thus, the information from these metacognitive experiences may not integrated with students' metacognitive knowledge if students do not realize their mental health could be influencing their learning. The same could be true for students not realizing their learning approaches could be influencing their mental health. By reflecting on their mental health data from the online SRL diary tool, students with lower mental health were able to identify how SRL processes and strategies were beneficial to their mental health. Thus, using metacognitive interventions, whether weekly or at strategic times during the semester that consider mental health and SRL as a heuristic process, should guide students through collecting and analyzing their learning data and potentially their mental health data, and how to enact change as needed.

Future research should examine how students incorporate monitoring of their mental health during learning and why students either choose to target mental health or not. For example, rather than the intervention selecting what facets (e.g., motivation, mental health, emotion) to monitor,

students could be provided with choices. Students could try monitoring their academic engagement, mental health, motivation, or goal progress for part of a semester. Then, after reflecting on their strengths and weaknesses as a learner, students could identify one or more areas they want to continue to monitor. Some students, even if their mental health is low, may benefit more from regulating their behaviour (e.g., academic engagement). Whereas other students may benefit more from targeting their mental health through enacting effective SRL strategies and processes, or by seeking help from the campus counselling centre. Importantly, any time mental health is included as something students can monitor, there should be information about accurate definitions and resources for mental health. The studies in this dissertation were conducted in a learning-to-learn course where students were taught about behaviour, cognition, motivation, emotion, metacognition, and mental health. In fact, accurate information about all facets of SRL should accompany metacognitive interventions when the intervention's aim is also to address faulty beliefs that could be impeding metacognitive processes.

Finally, creating absolute rules-of-thumb for learners about metacognition in SRL is challenging "because expressions of metacognition in SRL are complex, [and] research upon which to base practice may appear piecemeal, failing to paint a whole picture" (Winne, 2018, p. 45). Future research, however, should examine the successes and challenges of monitoring mental health during learning at university. For this line of research to have a wider reach, students in regular courses need access to these types of metacognitive interventions once they are further researched and developed. This provides a valuable opportunity for collaboration between students, educational psychologists, instructors, and student services professionals. Infusing best practices from SRL within mental health promotion programs will be a valuable addition to campuses around the world.

Conclusion

University students' mental health is a growing concern on campuses around the world. Mental health promotion programs are more prevalent, but few address the interplay between mental health and learning and how student success is affected. Previous studies on mental health and SRL established pre-existing interest in this convergence of topics (e.g., Howell, 2009; Grunschel et al., 2016; Peter et al., 2011). However, the between-person analyses and one-time measurement approaches used in these studies (a) limited the practical implications of the research, and (b) oversimplified the heuristic process of this interplay.

In particular, university students are in urgent need of interventions to both educate them about mental health and help foster their success at university. The aims of this dissertation were (a) to examine the interplay between self-regulated learning and mental health in student success at university, and (b) to explore a variety of methods and analyses examining between- and within-person differences in this interplay. Findings from this multi-paper dissertation provide important theoretical, empirical, and practical guidelines. One important finding highlights the utility of metacognitive SRL interventions for all students, regardless of mental health. However, there is still much work to be done in understanding the interplay between mental health and SRL; in particular, moving to research that incorporates both subjective and objective (i.e., multimodal) forms of measurement. The dynamic methods used in SRL research provide promising avenues for conducting future research that will continue to benefit students and help researchers unpack the complexity of this interplay.

Combining research on mental health and SRL brings together two fields of study that are ultimately both concerned with improving students' lives both in and out of academics. Perhaps one of the reasons why this interplay has only been minimally studied is because of the myriad challenges it presents to researchers. Our collective understanding of mental health and learning continues to grow. Thus, there is great potential for mental health to be incorporated into SRL

research that not only increases our understanding of how students learn, but also optimizes student success at university.

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Appendix A1: Ethics Certificate for Papers 1 and 2

University of Victoria | Office of Research Services | Human Research Ethics Board
Administrative Services Building Rm B202 PO Box 1700 STN CSC Victoria BC V8W 2Y2 Canada
T 250-472-4545 | F 250-721-8960 | uvic.ca/research | ethics@uvic.ca

Certificate of Renewed Approval

PRINCIPAL INVESTIGATOR:	**Allyson Hadwin**	**ETHICS PROTOCOL NUMBER:**	**08-07-308b**
UVic STATUS:	**Faculty**	ORIGINAL APPROVAL DATE:	20-Jun-08
UVic DEPARTMENT:	**EPLS**	RENEWED ON:	13-Jun-18
		APPROVAL EXPIRY DATE:	19-Jun-19

PROJECT TITLE: **PAR-21: Promoting Adaptive Regulation for the 21st Century**

RESEARCH TEAM MEMBER: Co-principal Investigator: Dr. Phil Winne (SFU);
COLLABORATORS: Dr. Sanna Järvelä (U of Oulu), Dr. Paul Kirschner (Open University of Netherlands), Dr. Margaret-Anne Storey (UVic), Dr. Peter Wild (UVic), Dr. Daniel Dinsmore (UNF), Dr. Meghan Parkinson (UNF), Dr. Lindsay McCardle (U of Ottawa), Dr. Mariel Miller (UVic), Dr. Todd Milford (UVic);
GRADUATE STUDENTS/RESEARCH ASSISTANTS (UVic): Elizabeth Webster, Aishah Bakhtiar, Rebecca Edwards, Shayla Starcheski, Sarah Davis, Priyanka Sharma, Natalie Usher, Sarah Greco

DECLARED PROJECT FUNDING: **Learning & Teaching Centre (2017); Technology Integrated Learning (2016); SSHRC Insight Funding (2012-2016); SSHRC Insight Funding (2008-2010); CFI-LOF (2009-2013); Learning Without Borders, Learning & Teaching Centre (2013); SSHRC Insight Grant (2018 - 2023)**

CONDITIONS OF APPROVAL

This Certificate of Approval is valid for the above term provided there is no change in the protocol.

Modifications
To make any changes to the approved research procedures in your study, please submit a "Request for Modification" form. You must receive ethics approval before proceeding with your modified protocol.

Renewals
Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.

Project Closures
When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.

Certification

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Participants.

Removed for submission

Dr. Rachael Scarth
Associate Vice-President Research Operations

Certificate Issued On: 13-Jun-18

08-07-308b Hadwin, Allyson

Appendix A2: Ethics Certificate for Paper 3

Board of Record
University of Victoria

Certificate of Ethical Approval for Harmonized Minimal Risk Study

Human Research Ethics Board (HREB)
Administrative Services Building
Room B202
PO Box 1700 STN CSC
Victoria, BC V8V 2Y2

Also reviewed and approved by:

Simon Fraser University

Principal Investigators: **Allyson Hadwin**

Primary Appointment: **University of Victoria**

Board of Record Approval Reference #: **BC18-275**

Study Title: **Examining Student Success: Promoting Adaptive Regulation with Innovative Technologies (PAR-IT)**

Study Approved: **13-SEP-2018** Expiry Date: **12-SEP-2019**

Research Team Members: **Collaborators: Dr. Phil Winne (SFU), Dr. Sanna Järvelä (U of Oulu, Finland), Dr. Hanna Jävenoja, U of Oulu, Finland), Dr. Mariel Miller (TIL, UVic), Dr. Todd Milford (EDCI, UVic);**
Graduate Student Research Assistants (UVic): Elizabeth Webster, Aishah Bakhtiar, Jiexing Hu, Sarah Davis, Sarah Greco, Ramin Rostampur

Sponsoring Agencies: **SSHRC Insight Grant**

Documents included in this approval:

Document Name	Approved received date
Human Research Ethics Board Application – V2	September 11, 2018
Appendix 1: Letter of Information – V2	September 11, 2018
Appendix 2: Data to be included from Institutional Planning – V2	September 11, 2018
Appendix 3: Email Script to ED-D101 Students – V2	September 11, 2018

This ethics approval applies to research ethics issues only and does not include provision for any administrative approvals required from individual institutions before research activities can commence.

The Board of Record (as noted above) has reviewed and approved this study in accordance with the requirements of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2, 2014).

The "Board of Record" is the Research Ethics board designated on behalf of the participating REBs involved in a harmonized study to facilitate the ethics review and approval process. In the event that there are any changes or amendments to this approved protocol, please notify the Board of Record.

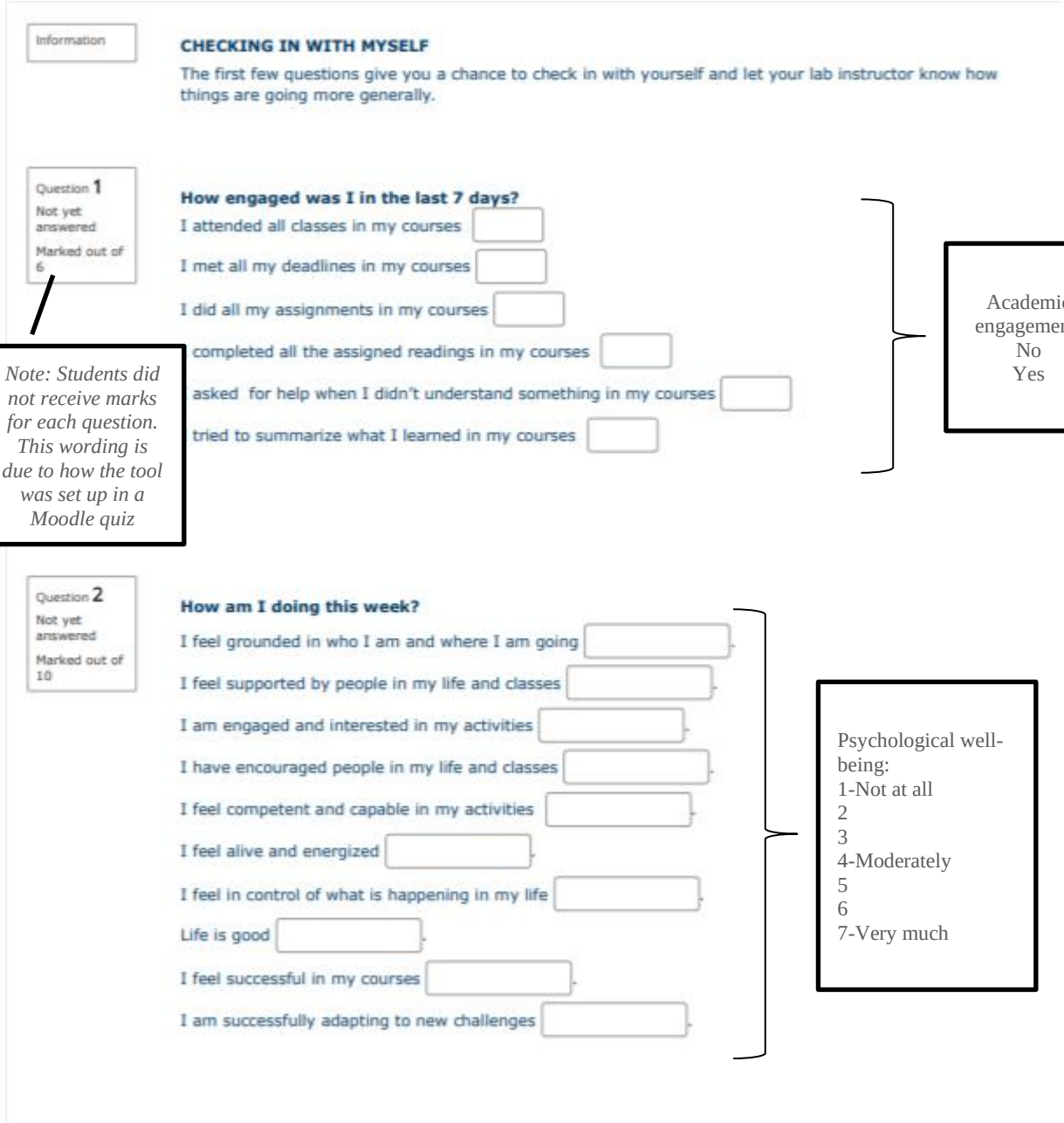
Board of Record Research Ethics Board Representative
Name: Dr. Rachael Scarth
Signature:

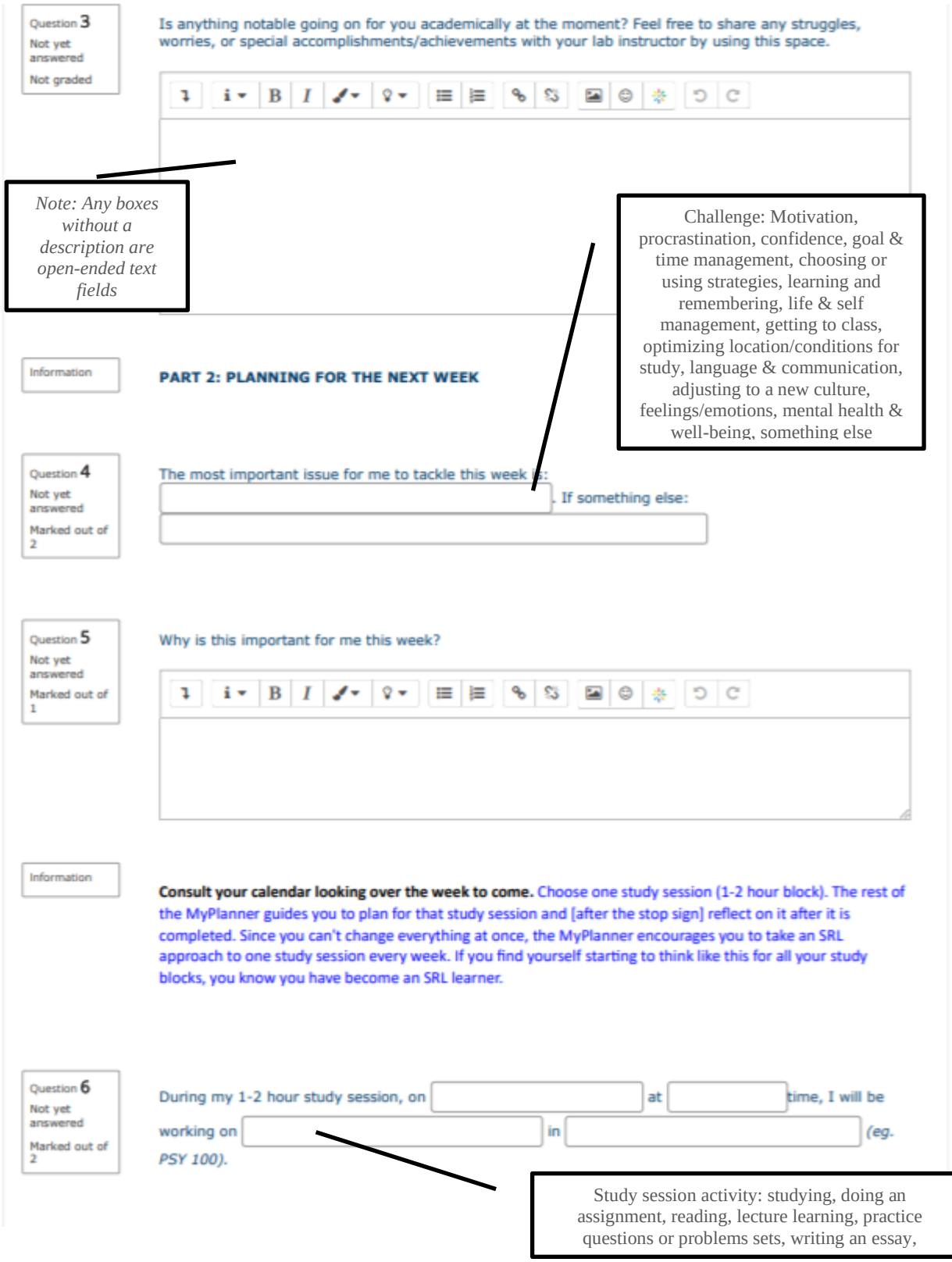
Title: Associate VP Research Operations
Date: 13-SEP-2018

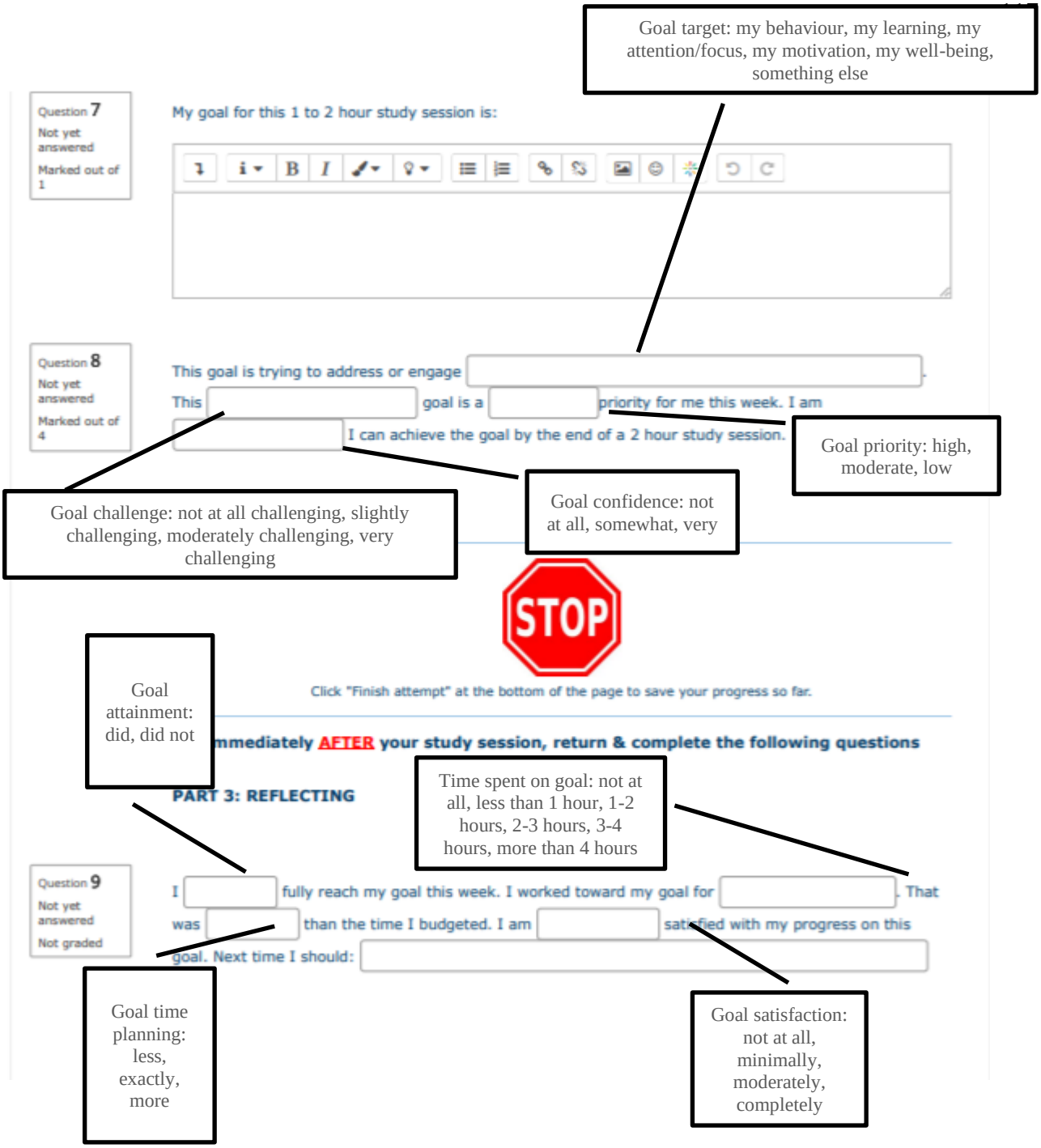
Removed for submission

Appendix A3: MyPlanner

Online SRL Diary Tool (Papers 1 and 2; Hadwin et al., 2018)




Question 3
Not yet answered
Not graded
Is anything notable going on for you academically at the moment? Feel free to share any struggles, worries, or special accomplishments/achievements with your lab instructor by using this space.
Note: Any boxes without a description are open-ended text fields
Challenge: Motivation, procrastination, confidence, goal & time management, choosing or using strategies, learning and remembering, life & self management, getting to class, optimizing location/conditions for study, language & communication, adjusting to a new culture, feelings/emotions, mental health & well-being, something else
Information
PART 2: PLANNING FOR THE NEXT WEEK
Question 4
Not yet answered
Marked out of 2
The most important issue for me to tackle this week is:
. If something else:
Question 5
Not yet answered
Marked out of 1
Why is this important for me this week?
Information
Consult your calendar looking over the week to come. Choose one study session (1-2 hour block). The rest of the MyPlanner guides you to plan for that study session and [after the stop sign] reflect on it after it is completed. Since you can't change everything at once, the MyPlanner encourages you to take an SRL approach to one study session every week. If you find yourself starting to think like this for all your study blocks, you know you have become an SRL learner.
Question 6
Not yet answered
Marked out of 2
During my 1-2 hour study session, on
at
time, I will be working on
in
(eg. PSY 100).
Study session activity: studying, doing an assignment, reading, lecture learning, practice questions or problems sets, writing an essay,

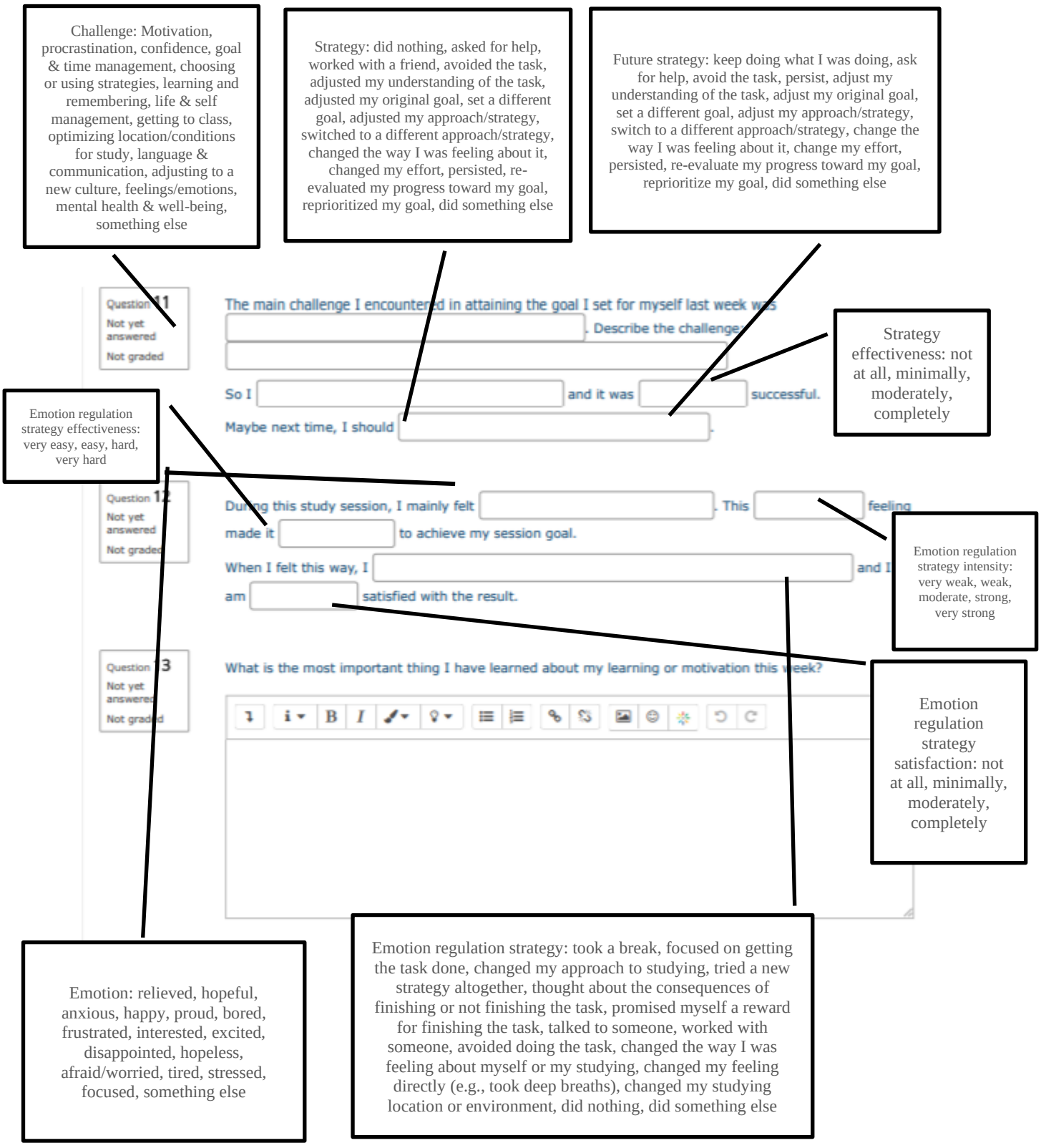

Goal target: my behaviour, my learning, my attention/focus, my motivation, my well-being, something else
Question 7
Not yet answered
Marked out of 1
My goal for this 1 to 2 hour study session is:
Question 8
Not yet answered
Marked out of 4
This goal is trying to address or engage
This
goal is a
priority for me this week. I am
I can achieve the goal by the end of a 2 hour study session.
Goal priority: high, moderate, low
Goal challenge: not at all challenging, slightly challenging, moderately challenging, very challenging
Goal confidence: not at all, somewhat, very
STOP
Click "Finish attempt" at the bottom of the page to save your progress so far.
Goal attainment: did, did not
mmediately AFTER your study session, return & complete the following questions
PART 3: REFLECTING
Time spent on goal: not at all, less than 1 hour, 1-2 hours, 2-3 hours, 3-4 hours, more than 4 hours
Question 9
Not yet answered
Not graded
I
fully reach my goal this week. I worked toward my goal for
. That
was
than the time I budgeted. I am
satisfied with my progress on this goal. Next time I should:
Goal time planning: less, exactly, more
Goal satisfaction: not at all, minimally, moderately, completely

Question 10
Not yet answered
Marked out of 11

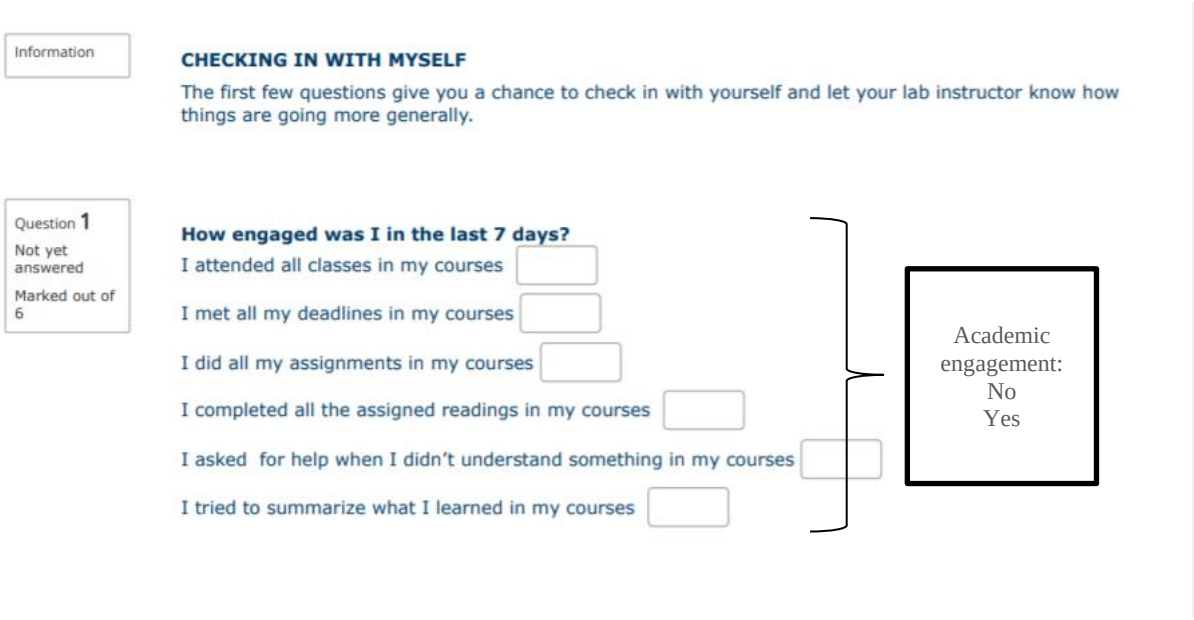
How much of a challenge were each of these during the last week?

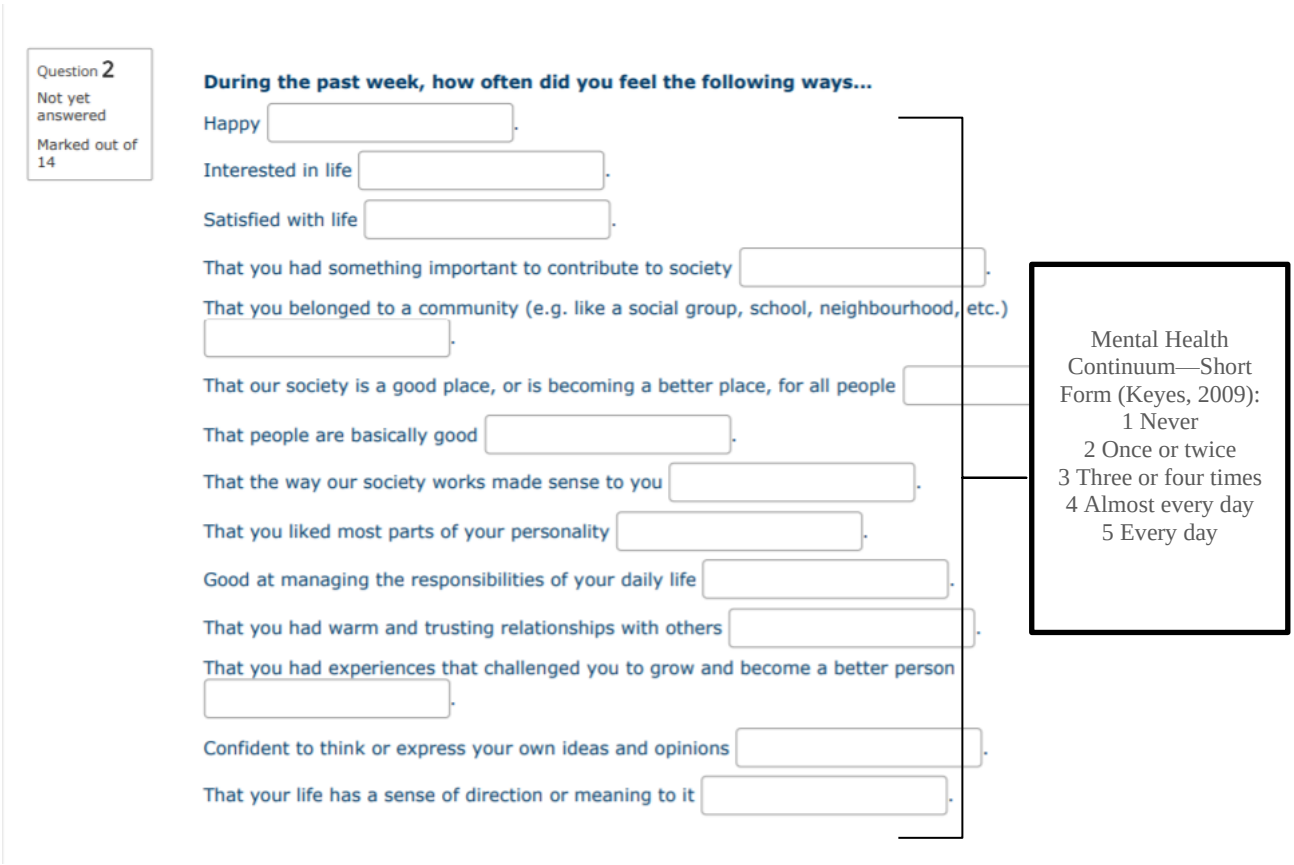
CHALLENGES	MY RATING	EXAMPLES
Motivation & Procrastination *The will or desire to do my work*		Difficulty persisting Difficulty getting started Low interest or will Kept putting it off
Confidence *Confidence in attaining my goal.*		Believing I could succeed Believing I could figure it out Doubting my ability Having low expectations of myself Feeling like I am bad at this
Goal & Time Management *Setting goals and managing & prioritizing time.*		Finding time to work Breaking things down into smaller goals Prioritizing time & tasks Organizing my time Running out of time Setting goals for studying Missing deadline/s
Choosing or Using Strategies *Knowing which strategies to use.*		Didn't know how to approach it Didn't know a strategy to use Chose the wrong strategy Didn't know how to fix my strategy
Learning & Remembering *Being able to remain focused on learning and remembering key information.*		Couldn't remember things Kept losing focus Couldn't figure out what was important Couldn't apply what I was learning Couldn't explain concepts/ideas
Life & Self-Management *Life events such as sleep, relationships or health.*		Distracted by other things in life Sick or tired Not eating well Family and relationship issues
Optimizing conditions/setting for study *Finding a suitable workspace.*		Finding a good workspace Too many distractions Distracted by friends/roommates Not conducive for thinking/learning
Language & Communication *Being able to communicate ideas.*		Didn't understand words Couldn't express ideas Stuck on terminology Didn't know how to ask a question Couldn't think about it in English
Adjusting to a New Culture *Adjusting to new learning situations and contexts; making new friends*		Feeling lonely Missing friends/family Unsure of what is expected of me Unsure of what is appropriate Overwhelmed by how different things are
Emotions *The role emotions played in your work this week.*		Anxiety, boredom, excitement, worry, anger, frustration, sadness, hopelessness, guilt, shame, disappointment, etc.
Mental Health & Well-Being *How I cope with relationships, work, and stress to be productive.*		Feeling stressed or overwhelmed most days, not enjoying being at university, struggling with social relationships, not feeling in control of my life.

Challenge rating:
0-Not applicable this week
1
2
3
4
5-Negatively affected me this week


Challenge: Motivation, procrastination, confidence, goal & time management, choosing or using strategies, learning and remembering, life & self management, getting to class, optimizing location/conditions for study, language & communication, adjusting to a new culture, feelings/emotions, mental health & well-being, something else
Strategy: did nothing, asked for help, worked with a friend, avoided the task, adjusted my understanding of the task, adjusted my original goal, set a different goal, adjusted my approach/strategy, switched to a different approach/strategy, changed the way I was feeling about it, changed my effort, persisted, re-evaluated my progress toward my goal, reprioritized my goal, did something else
Future strategy: keep doing what I was doing, ask for help, avoid the task, persist, adjust my understanding of the task, adjust my original goal, set a different goal, adjust my approach/strategy, switch to a different approach/strategy, change the way I was feeling about it, change my effort, persisted, re-evaluate my progress toward my goal, reprioritize my goal, did something else
Question 11
Not yet answered
Not graded
The main challenge I encountered in attaining the goal I set for myself last week was
. Describe the challenge.
So I
and it was
successful.
Maybe next time, I should
.
Strategy effectiveness: not at all, minimally, moderately, completely
Emotion regulation strategy effectiveness: very easy, easy, hard, very hard
Question 12
Not yet answered
Not graded
During this study session, I mainly felt
. This
feeling
made it
to achieve my session goal.
When I felt this way, I
and I
am
satisfied with the result.
Emotion regulation strategy intensity: very weak, weak, moderate, strong, very strong
Question 13
Not yet answered
Not graded
What is the most important thing I have learned about my learning or motivation this week?
Emotion regulation strategy satisfaction: not at all, minimally, moderately, completely
Emotion: relieved, hopeful, anxious, happy, proud, bored, frustrated, interested, excited, disappointed, hopeless, afraid/worried, tired, stressed, focused, something else
Emotion regulation strategy: took a break, focused on getting the task done, changed my approach to studying, tried a new strategy altogether, thought about the consequences of finishing or not finishing the task, promised myself a reward for finishing the task, talked to someone, worked with someone, avoided doing the task, changed the way I was feeling about myself or my studying, changed my feeling directly (e.g., took deep breaths), changed my studying location or environment, did nothing, did something else

Online SRL Diary Tool (Paper 3; Hadwin et al., 2019)





Question 3
Not yet answered
Not graded

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Information

PART 2: PLANNING FOR THE NEXT WEEK

Question 4
Not yet answered
Marked out of 2

The most important issue for me to tackle this week is: . If something else:

Question 5
Not yet answered
Marked out of 1

Why is this important for me this week?

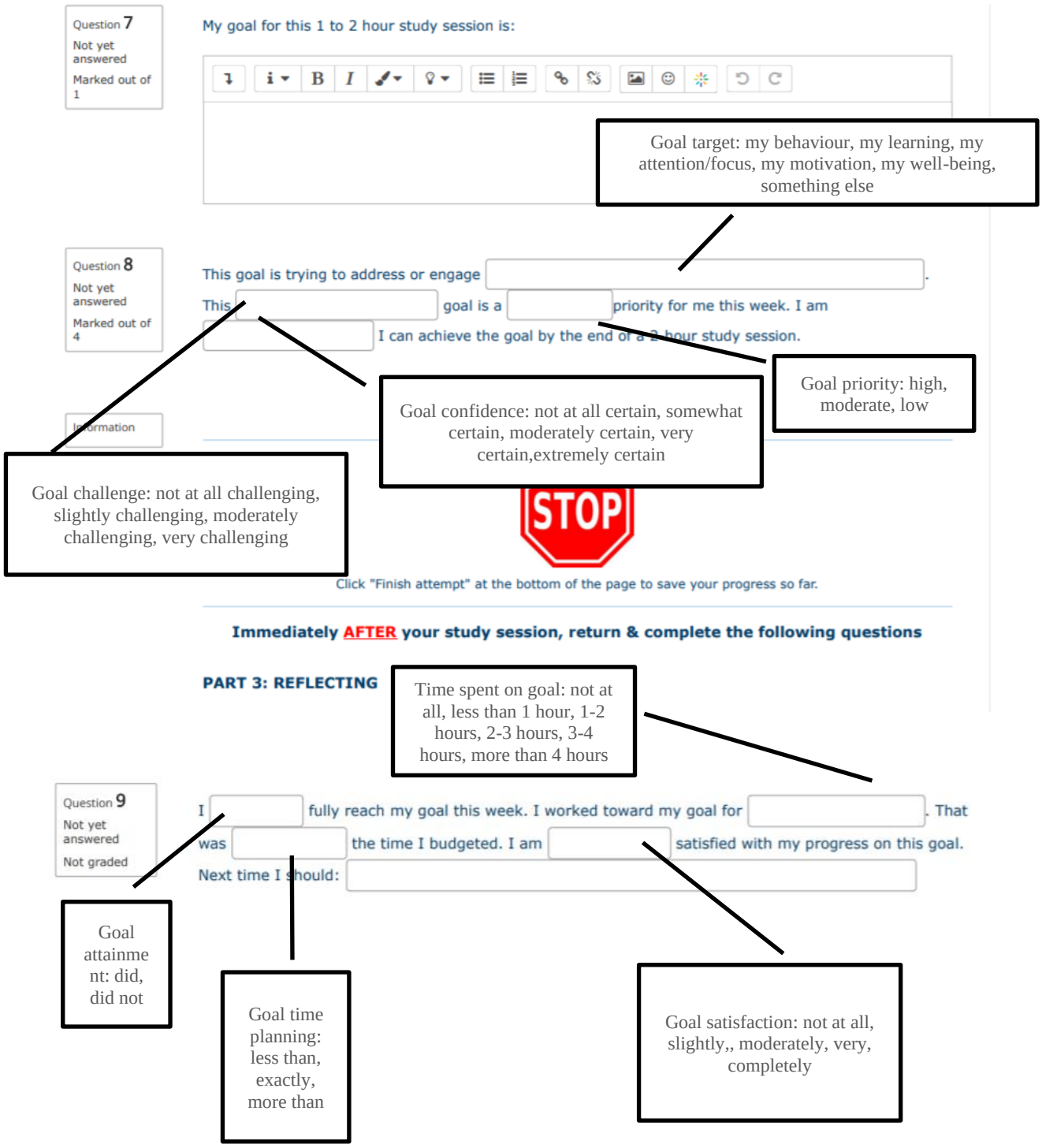
Information

Consult your calendar looking over the week to come. Choose one study session (1-2 hour block). The rest of the MyPlanner guides you to plan for that study session and [after the stop sign] reflect on it after it is completed. Since you can't change everything at once, the MyPlanner encourages you to take an SRL approach to one study session every week. If you find yourself starting to think like this for all your study blocks, you know you have become an SRL learner.

Question 6
Not yet answered
Marked out of 2

During my 1-2 hour study session, on _____ at _____ time, I will be working on _____ in _____ *(eg. PSY 100).*

Study session activity: studying, doing an assignment, reading, lecture learning, practice questions or problems sets, writing an essay,


Question 7
Not yet answered
Marked out of 1
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Goal target: my behaviour, my learning, my attention/focus, my motivation, my well-being, something else
Question 8
Not yet answered
Marked out of 4
This goal is trying to address or engage
This goal is a priority for me this week. I am
I can achieve the goal by the end of a 2 hour study session.
Goal priority: high, moderate, low
Goal confidence: not at all certain, somewhat certain, moderately certain, very certain,extremely certain
Goal challenge: not at all challenging, slightly challenging, moderately challenging, very challenging
STOP
Click "Finish attempt" at the bottom of the page to save your progress so far.
Immediately AFTER your study session, return & complete the following questions
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Time spent on goal: not at all, less than 1 hour, 1-2 hours, 2-3 hours, 3-4 hours, more than 4 hours
Question 9
Not yet answered
Not graded
I fully reach my goal this week. I worked toward my goal for . That
was the time I budgeted. I am satisfied with my progress on this goal.
Next time I should:
Goal attainment: did, did not
Goal time planning: less than, exactly, more than
Goal satisfaction: not at all, slightly,, moderately, very, completely

Question 10
Not yet answered
Marked out of 11

How much of a challenge were each of these during the last week?

CHALLENGES	MY RATING	EXAMPLES
Motivation & Procrastination *The will or desire to do my work*		Difficulty persisting Difficulty getting started Low interest or will Kept putting it off
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Goal & Time Management *Setting goals and managing & prioritizing time.*		Finding time to work Breaking things down into smaller goals Prioritizing time & tasks Organizing my time Running out of time Setting goals for studying Missing deadline/s
Choosing or Using Strategies *Knowing which strategies to use.*		Didn't know how to approach it Didn't know a strategy to use Chose the wrong strategy Didn't know how to fix my strategy
Learning & Remembering *Being able to remain focused on learning and remembering key information.*		Couldn't remember things Kept losing focus Couldn't figure out what was important Couldn't apply what I was learning Couldn't explain concepts/ideas
Mental Health & Well-being *How I cope with relationships, work, and stress to be productive.*		Sick/tired or not eating well Not enjoying being at university Family and relationship issues Feeling stressed and overwhelmed most days Not feeling in control of my life
Optimizing conditions/setting for study *Finding a suitable workspace.*		Finding a good workspace Too many distractions Distracted by friends/roommates Not conducive for thinking/learning
Language & Communication *Being able to communicate ideas.*		Didn't understand words Couldn't express ideas Stuck on terminology Didn't know how to ask a question Couldn't think about it in English
Adjusting to a New Culture *Adjusting to new learning situations and contexts; making new friends*		Feeling lonely Missing friends/family Unsure of what is expected of me Unsure of what is appropriate Overwhelmed by how different things are
Emotions *The role emotions played in your work this week.*		Anxiety, boredom, excitement, worry, anger, frustration, sadness, hopelessness, guilt, shame, disappointment, etc.

Challenge rating:
0-Not applicable this week
1
2
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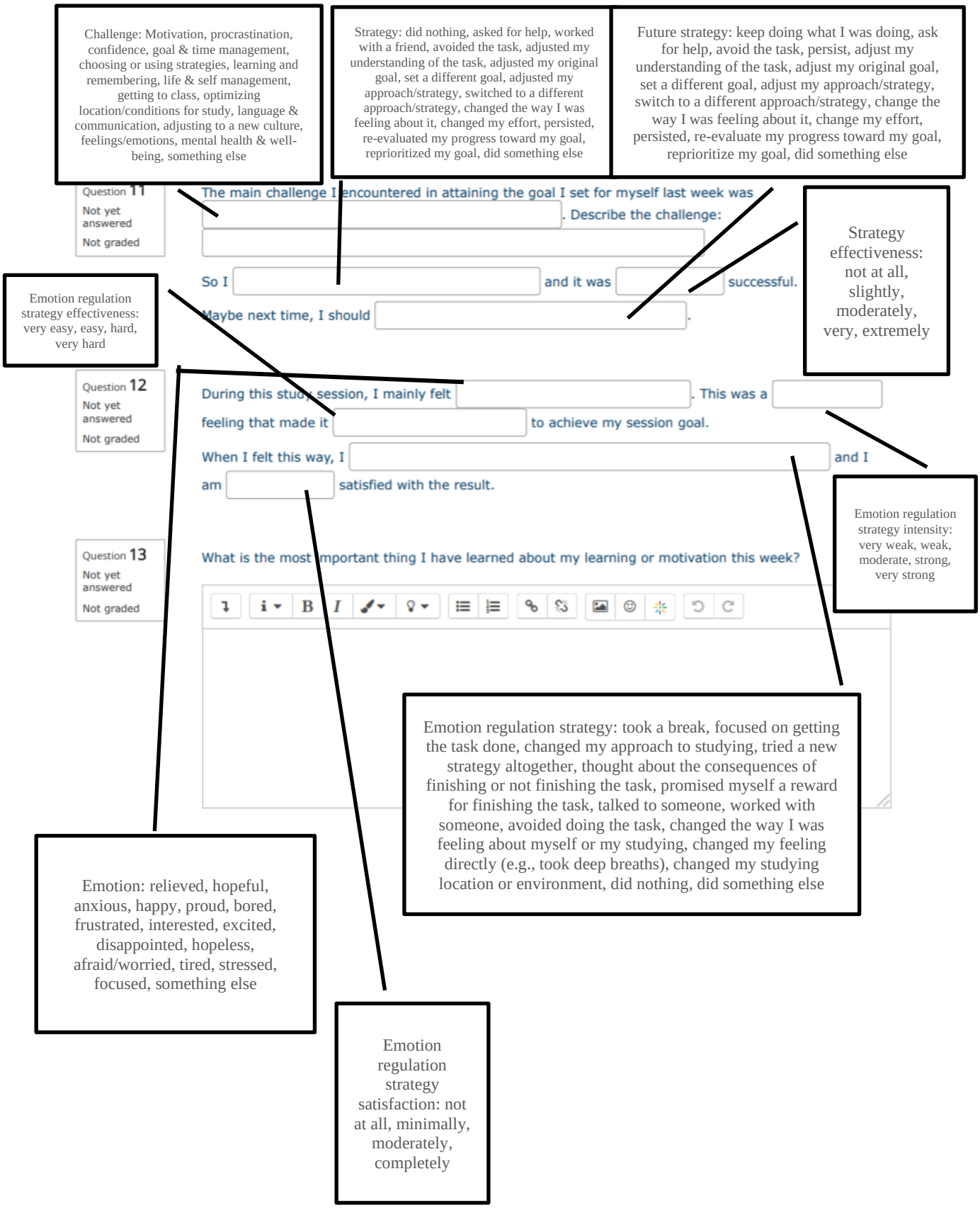
5-Negatively affected me this week


Challenge: Motivation, procrastination, confidence, goal & time management, choosing or using strategies, learning and remembering, life & self management, getting to class, optimizing location/conditions for study, language & communication, adjusting to a new culture, feelings/emotions, mental health & well-being, something else
Strategy: did nothing, asked for help, worked with a friend, avoided the task, adjusted my understanding of the task, adjusted my original goal, set a different goal, adjusted my approach/strategy, switched to a different approach/strategy, changed the way I was feeling about it, changed my effort, persisted, re-evaluated my progress toward my goal, reprioritized my goal, did something else
Future strategy: keep doing what I was doing, ask for help, avoid the task, persist, adjust my understanding of the task, adjust my original goal, set a different goal, adjust my approach/strategy, switch to a different approach/strategy, change the way I was feeling about it, change my effort, persisted, re-evaluate my progress toward my goal, reprioritize my goal, did something else
Question 11
Not yet answered
Not graded
The main challenge I encountered in attaining the goal I set for myself last week was
. Describe the challenge:
So I
and it was
successful.
Maybe next time, I should
.
Strategy effectiveness: not at all, slightly, moderately, very, extremely
Emotion regulation strategy effectiveness: very easy, easy, hard, very hard
Question 12
Not yet answered
Not graded
During this study session, I mainly felt
. This was a
feeling that made it
to achieve my session goal.
When I felt this way, I
and I am
satisfied with the result.
Emotion regulation strategy intensity: very weak, weak, moderate, strong, very strong
Question 13
Not yet answered
Not graded
What is the most important thing I have learned about my learning or motivation this week?
Emotion regulation strategy: took a break, focused on getting the task done, changed my approach to studying, tried a new strategy altogether, thought about the consequences of finishing or not finishing the task, promised myself a reward for finishing the task, talked to someone, worked with someone, avoided doing the task, changed the way I was feeling about myself or my studying, changed my feeling directly (e.g., took deep breaths), changed my studying location or environment, did nothing, did something else
Emotion: relieved, hopeful, anxious, happy, proud, bored, frustrated, interested, excited, disappointed, hopeless, afraid/worried, tired, stressed, focused, something else
Emotion regulation strategy satisfaction: not at all, minimally, moderately, completely

Appendix A4: MHC-SF and Psychological well-being measure

Psychological well-being (adapted from Rush & Grouzet, 2012)	
How am I doing this week?	Likert Scale
I feel grounded in who I am and where I am going	1 Not at all 4 Moderately 7 Very much
I feel supported by people in my life and classes	
I am engaged and interested in my activities	
I have encouraged people in my life and classes	
I feel competent and capable in my activities	
I feel alive and energized	
Life is good	
I feel successful in my courses	
I am successfully adapting to new challenges	

Mental health continuum-Short form (adapted from Keyes, 2009)	
During the past week, how often did you feel the following ways…	
Happy	1 Never 2 Once or Twice 3 Three or four times 4 Almost 5 Every day
Interested in life	
Satisfied with life	
That you had something important to contribute to society	
That you belonged to a community (e.g., like a social group, school, neighbourhood, etc.)	
That our society is a good place, or is becoming a better place, for all people	
That people are basically good	
That the way our society works made sense to you	
That you liked most parts of your personality	
Good at managing the responsibilities of your daily life	
That you had warm and trusting relationships with others	
That you had experiences that challenged you to grow and become a better person	
Confident to think or express your own ideas and opinions	
That your life has a sense of direction or meaning to it	

Appendix B1: Consent Withdrawal Form for Papers 1 and 2

UVic
Department of Educational Psychology & Leadership Studies

Consent Withdrawal Form

Technology Integration and Evaluation Research Lab

Why participate in research that evaluates student learning and the ED-D 101 Course?

In ED-D 101, you have the opportunity to experiment with your own learning in order to become a better learner. The information and practices that guide you through this process have been developed from theory and research about student learning. Each semester, ED-D 101 undergoes changes and revisions based on findings from the ED-D 101 research. Learning experiences from a large number of students are needed to continue to improve the course. By participating in this research you inform students, researchers, university instructors, and administrators who strive to help students succeed at university.

Purpose of the research

- To understand how to support students (like yourself) to become academically successful and develop lifelong learning skills.
- To compare learning processes and successes of ED-D 101 students with students who have not taken the course.
- To inform evidence-based decision making about ED-D 101 (expansion, course content, course activities).
- To inform theory and research about strategic regulation in educational psychology and educational technology.

Participation in this research involves:

- ***No additional work or time***. Your regular coursework will be examined for research purposes after the course is completed and final grades have been submitted. Data include:
  - ED-D 101 course assignments, lab activities, tests, and discussions (online or audio/video recorded) submitted to CourseSpaces and Fluidsurvey;
  - ED-D 101 CourseSpaces data, including activity reports;
  - Course and assignment grades for concurrent Pathways course; and
  - institutionally collected performance indicators (e.g. GPA, yearly GPA, and exit surveys) throughout your undergraduate degree
- ***There are no known or anticipated risks.***

Participation is voluntary: You can withdraw at anytime

You may withdraw anytime this semester by clicking on the electronic consent form in CourseSpaces and indicating “decline to participate”. In the case of group work, withdrawal of participation will mean that an individual’s contributions to the group will not be examined. When individuals cannot be removed completely from the data sets (e.g., group project grade or shared planning forms), data will be used in summarized form with no identifying information.

Data will be confidential even though coursework is not anonymous

Course assignments and activities with your name or student ID are not anonymous. However, your confidentiality will be protected by (1) summarizing data in a spreadsheet with a random case number whenever possible and (2) summarizing data across many students or using pseudonyms when specific examples are used.

Course instructors will not know you are participating in this research

Instructors and teaching assistants will not know who has consented to participate in the research during the semester. Consent forms will be collected by a third party and released to the research team after course completion and grade submission.

What will happen to data and how will findings be reported and shared?

Electronic data will be archived and stored on a password protected server only accessible to the researchers. Files will be stored for approximately 10 years, after which they will be erased. Data will be analyzed by Dr. Hadwin and her research collaborators. Findings will be presented through academic publications/presentations, the research website (http://allysonhadwin.wordpress.com/), student theses, and reports to university administrators. Identifying information will be removed whenever examples are used in ED-D 101 or presentations.

Social Networking Privacy Notice

Some activities/assignments in this course use social networking platforms such as Google + or ZohoChat. Please be advised that data collected within these platforms are likely stored on servers located outside of Canada. As a result, retention, access to, and the secondary use and disclosure of any personal information you disclose are subject to the social networking site's terms of use, privacy policies and foreign law. You are encouraged you to read the social networking site's terms and conditions on their website prior to starting any activities. Students are encouraged to use first name and last initial only when using these networking tools.

UVic cannot require students to disclose personal information to technologies or organizations which may store information on servers located outside of Canada because disclosure of personal information to vendors, systems or services storing or accessing that personal information outside of Canada is restricted by Section 30.1 of BC's Freedom of Information and Protection of Privacy Act (FIPPA). Personal information is information about an identifiable individual; for example, your name or your email address. If you are not comfortable with your personal information being stored outside of Canada, you may sign up for the tool using a nickname and non-identifying email. However, you will be required to inform your instructor of the nickname and email you choose.

Contacts

Feel free to contact any of the following with questions, comments, or concerns:

- *During the course:* Dr. Tim Black (eplschr@uvic.ca) or Dr. Ralf St. Clair (deaneduc@uvic.ca)
- *After the course:* Dr. Allyson Hadwin (hadwin@uvic.ca) [Note: Do not contact Dr. Hadwin during the course because she is a course instructor and cannot know which students are participating until course grades are submitted.]
- Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

This research (***Par21: Promoting Adaptive Regulation for the 21st Century***) is led by Dr. Allyson Hadwin (Principal Investigator) and funded by the Social Sciences and Humanities Research Council of Canada (SSHRC-INE grant) and the Canadian Foundation for Innovation (CFI-LOF).

By registering in ED-D 101, you are automatically included in research about student learning and success. Your signature below indicates that you would like to withdraw your consent from research in ED-D 101.

Name: _____ *Signature:* _____ *Date:*_____

Appendix B2: Consent Withdrawal Form for Paper 3

UVic

Department of Educational Psychology & Leadership Studies

ED-D101 Research Information
&
How to decline to participate

Technology Integration and Evaluation Research Lab

Why participate in research that evaluates student learning and the ED-D 101 Course?

In ED-D 101, you have the opportunity to experiment with your own learning in order to become a better learner. The information and practices that guide you through this process have been developed from theory and research about student learning. Each semester, ED-D 101 undergoes revisions based on findings from the ED-D 101 research. Learning experiences from a large number of students are needed to continue to improve the course. By participating in this research, you inform students, researchers, university instructors, and administrators who strive to help students succeed at university.

Purpose of the research

- To understand how to support students (like yourself) to become academically successful and develop lifelong learning skills.
- To compare learning processes and successes of ED-D 101 students with students who have not taken the course, and/or with students who received different types of support for developing their academic skills.
- To inform evidence-based decision making about ED-D 101 (expansion, course content, course activities).
- To inform theory and research about strategic regulation in educational psychology and educational technology.

Participation in this research involves:

- ***No additional work or time*****.** Your regular coursework will be examined for research purposes after the course is completed and final grades have been submitted. Data include:
  - ED-D 101 course assignments, lab activities, tests, and discussions (online or audio/video recorded).
  - ED-D 101 CourseSpaces data including activity reports;
  - Data gathered through a mobile application, Metricwire, used for your studying and collaborative work in ED-D101, and
  - Institutionally collected performance indicators (e.g., GPA, yearly GPA, and exit surveys) throughout your undergraduate degree
- ***There are no known or anticipated risks.***

Participation is voluntary: You can withdraw at anytime

By taking this course, you are automatically included in ED-D 101 research. However, you may withdraw anytime this semester by clicking on the electronic consent form in CourseSpaces and indicating "decline to participate". In the case of group work, withdrawal of participation will mean that an individual's contributions to the group will not be examined. When individuals cannot be removed completely from the data sets (e.g., group project grade or shared planning forms), data will be used in summarized form with no identifying information. Course instructors will not know that you have withdrawn consent until after course completion and grade submission. Your participation in this research will not influence your grade in the course**.**

Data will be confidential even though coursework is not anonymous

Course assignments and activities with your name or student ID are not anonymous. However, your confidentiality will be protected by (1) summarizing data in a spreadsheet with a random case number whenever possible and (2) summarizing data across many students or using pseudonyms when specific examples are used.

Course instructors will not know you are participating in this research

Instructors and teaching assistants will not know who has consented to participate in the research during the semester. Consent forms will be collected by a third party and released to the research team after course completion and grade submission.

What will happen to data and how will findings be reported and shared?
Electronic data will be archived and stored on a password protected server only accessible to the researchers. Files will be stored for approximately 10 years, after which they will be erased. Paper-based data will be stored in a locked filing cabinet in Maclaurin A210 for 10 years, after which they will be shredded. Data will be analyzed by Dr. Hadwin and her research collaborators. Findings will be presented through academic publications/presentations, the research website (http://allysonhadwin.wordpress.com/), student theses, and reports to university administrators. Identifying information will be removed whenever examples are used in ED-D 101 or presentations.

Social Networking Privacy Notice
Some activities/assignments in this course use social networking platforms such as Google. Please be advised that data collected within these platforms are likely stored on servers located outside of Canada. As a result, retention, access to, and the secondary use and disclosure of any personal information you disclose are subject to the social networking site's terms of use, privacy policies and foreign law. You are encouraged to read the social networking site's terms and conditions on their website prior to starting any activities. Students are encouraged to use first name and last initial only when using these networking tools.
UVic cannot require students to disclose personal information to technologies or organizations which may store information on servers located outside of Canada because disclosure of personal information to vendors, systems or services storing or accessing that personal information outside of Canada is restricted by Section 30.1 of BC's Freedom of Information and Protection of Privacy Act (FIPPA). Personal information is information about an identifiable individual; for example, your name or your email address. If you are not comfortable with your personal information being stored outside of Canada, you may sign up for the tool using a nickname and non-identifying email. However, you will be required to inform your instructor of the nickname and non-identifying email.

Mobile Application Privacy Notice
MetricWire is a Canadian company and your data will be stored on a secure server. MetricWire's servers were built to comply with BC's Freedom of Information and Protection of Privacy Act (FIPPA). Only the research team members at Metricwire will have access to your data. This is the facility where your course work and activity logs used within the Metricwire app will be merged with your ED-D101 course data, and subsequently anonymized. Data collected within this app cannot be sold to other third-party individuals or organizations. If you choose not to use Metricwire as part of your course activity, you may opt to complete the activity in CourseSpaces.

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- *After the course:* Dr. Allyson Hadwin (hadwin@uvic.ca) [Note: Do not contact Dr. Hadwin during the course because she is a course instructor and cannot know which students are participating until course grades are submitted.]
- Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

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Name	*Signature*	*Date*

Appendix C1: Paper 1

Davis, S. K. & Hadwin, A. F. (2019). Exploring differences in psychological well-being and self-regulated learning in university student success. *Manuscript in submission.*

Exploring differences in psychological well-being and self-regulated learning in university student success

Sarah K. Davis and Allyson F. Hadwin
University of Victoria

Author Note

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Abstract

The majority of North American postsecondary students report (a) feeling inundated and exhausted by academic work, and (b) experiencing levels of stress and anxiety compromising mental health, academic learning, and personal success (ACHA, 2018). Previous research has established psychological well-being (PWB) and self-regulated learning (SRL) are important components of student success (Howell, 2009), however, there is a paucity of research examining the interplay between these factors during a semester-long course. In this study, 118 students in a learning-to-learn elective university course completed nine weekly online SRL planning and reflection tools. Students planned for a study session, completed an academic engagement and a PWB measure, then reflected on a challenge faced and described the strategy chosen to overcome that challenge. Findings revealed (a) students who reported always attaining their goals also reported higher overall PWB, and (b) within-person patterns of PWB and academic engagement over time may affect regulatory responses to challenge or vice versa. Implications for theory, research, and practice are discussed.

Keywords: Goal attainment; process mining; psychological well-being; self-regulated learning; student success.\

Exploring differences in psychological well-being and self-regulated learning in university student success

University students' mental health is a growing concern globally. North American postsecondary students report: (a) feeling exhausted by academic work, and (b) experiencing levels of stress and anxiety compromising mental health, academic learning, and personal success (ACHA, 2018). One out of four Australian university students experiences high levels of distress (Larcombe et al., 2015), and in the UK, 78% of postsecondary students reported experiencing problems with their mental health in the past year (National Union of Students, 2015). Across Europe, findings are mixed: university students' mental health tends to be better than the rest of the general population, however more students are reporting struggling with mental illness in the past 15 years (Rückert, 2015). These high levels of distress could be due to any number of challenges at university. However, the consequences of poor mental health on postsecondary students are clear: mental health concerns are a common reason given by university students who take a temporary leave of absence or drop out altogether (Yorke & Longden, 2008). Preventing this attrition is daunting because few students experiencing mental health challenges seek help (ACHA, 2018). In addition, the problems students experience at university may be compounded by the challenges they encounter while attempting to engage with and master coursework. Specifically, while completing coursework, students report encountering problems with motivation and beliefs, planning and goal setting, well-being, emotion, and cognition (Hadwin et al., 2019). These challenges interfere with student success at university. However, there is a paucity of research examining how academic challenges encountered during learning affect mental health at university.

Mental Health

Mental health, distinct from mental illness, refers to a state of well-being in which individuals cope with stressors, work productively, and contribute to society (WHO, 2016). In Keyes' dual-continua model, mental illness and mental health do not exist as opposite ends of a single

continuum, but rather as distinct, correlated axes suggesting mental health is a separate state (see Figure 1; Keyes, 2005, 2013). Including both hedonic (i.e., positive feeling defined as emotional well-being) and eudaimonic (i.e., positive functioning defined as psychological and social well-being) perspectives in defining mental health is vital for understanding overall human well-being (Deci & Ryan, 2008). There are three factors in Keyes' mental health model: psychological, social, and emotional well-being (Keyes, 2002). In sum, mental health is how individuals perceive and evaluate their own affective states, and psychological and social functioning.

Figure 1. Keyes' dual-continua model of mental health. Figure from "Promoting and protecting positive mental health: Early and often throughout the lifespan," by C. L. M. Keyes in C. L. M. Keyes (Ed.), Mental well-being: International contributions to the study of positive mental health (p. 17), 2013, Springer Netherlands. Copyright 2013 by C. L. M. Keyes. Reprinted with permission.

Psychological Well-Being

For this exploratory study, we focused on psychological well-being (PWB) as the mental health factor of interest because PWB may be particularly important to student success and learning at university (Howell, 2009). This is because PWB characterizes the process of living and functioning well and actualizing human potential (i.e., eudaimonia; Ryan et al., 2008) which are particularly relevant to university functioning. PWB captures myriad concepts related to eudaimonia, including self-acceptance, positive relations with others, personal growth, life purpose, autonomy, environmental mastery (Keyes, 2013; Ryff & Keyes, 1995; Ryff & Singer, 1998), and relatedness, competence, engagement, and meaning (Diener et al., 2010). The specific concepts captured by PWB may differ depending on what conceptualization and/or measure is used.

For example, in self-determination theory, Ryan and Deci (2001) explain eudaimonic living is *fostered* by pursuing intrinsic goals, satisfying basic psychological needs for competence and relatedness, being mindful and acting with awareness, and behaving autonomously. This is in comparison to other conceptualizations, for example, Ryff & Singer (1998) whose widely used six dimensions indicate the *presence* of PWB. In addition, others define psychological well-being as being synonymous with happiness (e.g., Hills & Argyle, 2001), or hedonic well-being indicating positive or negative affect or satisfaction with life. As this study uses Keyes' theoretical framework, psychological well-being in this study is defined as how individuals perceive the quality of their functioning in life, or eudaimonia (Keyes, 2013).

The role of PWB is of particular interest in student success research due to the recent shift in the field from only focusing on symptoms of mental disorders at university (e.g., ACHA, 2018), to understanding the factors contributing to students' PWB at university. Previous research indicates students' high well-being in high school predicts high well-being in the first weeks of university, and well-being decreases during a university semester (De Coninck et al., 2019). In addition, students' optimism is the best predictor of high PWB and lower levels of psychological distress (Burris et al., 2009), and student involvement in campus organizations and sports has a positive effect on fourth year PWB (Kilgo et al., 2016). Current approaches to research on PWB contribute greatly to the understanding of PWB at university. However, gaps in the field include considering how PWB fluctuates over time at university and the interplay of PWB, learning, and student success.

Student Success and Self-Regulated Learning at University

Traditional definitions of student success focus on attaining a degree at the institution of attendance (Kuh et al., 2007). Current definitions of student success are moving from defining success only at the institutional level to defining success at the student level. A meta-analysis of student success research defined success in the first year of university through the three domains of critical thinking, academic achievement, and socio-emotional well-being (van der Zanden et al.,

2018). This multidimensional view recognizes students may define success for themselves in different ways. Thus, this current study operationalizes student success at an even finer-grained level: student success is when students attain self-set goals (e.g., academic, social, etc.) to self-determined standards of excellence by exercising strategic metacognitive monitoring and control of behaviors, emotions, motivation, and cognition within and across study sessions.

Self-regulated learning (SRL) is vital for student success because self-regulation is ubiquitous. At university, self-regulating learners take control of their own learning, motivation, affect, and behaviors while striving to attain their own academic and personal goals (Schunk & Greene, 2018; Zimmerman, 1989; Zimmerman & Schunk, 2001). The vast amount of information and choices in university can easily become overwhelming and students need to be active participants in their learning by engaging in regulating their learning, rather than by being passive recipients of information (Pintrich, 2004). In SRL research, challenges provide opportunities for both researchers and students to examine regulated learning as students are trying to attain goals (Hadwin & Winne, 2012). To become strategic learners, students (a) proactively take control of their learning by setting goals, (b) progressively develop metacognitive awareness, (c) monitor and evaluate their learning conditions, and (d) adapt their approaches when needed (Winne, 2001; Zimmerman, 1989). Increasing metacognitive knowledge and self-monitoring skills through SRL can help students overcome academic challenges and effectively develop coping strategies to deal with them (Zimmerman & Martinez-Pons, 1990).

Challenges are central to university and may hinder or constrain PWB and/or learning, however limited research examines the interplay between SRL and PWB around academic challenges. From previous research on SRL and psychopathology at university, (a) students who experienced high levels of psychological distress may be unable to persist when they experience failure or challenges to complete academic tasks (Brackney & Karabenick, 1995); and (b) medical students who report using more SRL strategies also reported lower rates of depression (Van Nguyen et al., 2015). In a study on mental health and SRL using Keyes' (2002, 2005)

conceptualization found, students with flourishing mental health also had the highest levels of overall adaptive academic functioning, defined as having a growth mindset, setting mastery goals, not procrastinating, and having high self-control (Howell, 2009). Finally, students' use of effective motivation regulation strategies indirectly affected academic performance and emotional well-being (Grunschel et al., 2016). Salient components of PWB include a sense of autonomy and life purpose, and as such, goal setting and attainment are critical. For this reason, examining PWB and SRL may provide further insight into the specific role of PWB in student success.

Purpose and Research Questions

This study aimed to examine the interplay between PWB and SRL as students plan for and reflect on their approaches to attaining self-set academic goals over nine consecutive weeks. We had two research questions: (a) does PWB differ between groups of students with varying goal attainment?, and (b) how do patterns of regulation over the semester differ between a student who consistently attains weekly study goals (i.e., high goal attainment) and a student who does not (i.e., low-moderate goal attainment)? Based on the findings from Howell (2009), we hypothesized students with higher goal attainment will also have higher PWB, and they will regulate their learning around challenges differently than students with lower PWB.

Methods

Participants

Students from across the university were enrolled in an undergraduate elective course on learning strategies for university success in the fall semester of 2017. This educational psychology course taught the theory, research and practice of strategic learning, motivation, and behaviour with a self-regulated learning lens framed around Winne & Hadwin's (1998) SRL model. Students attended one 90-minute lecture and one 90-minute lab section each week and were enrolled in at least one other course concurrently. Consenting participants in this study were 140 students. We had two criteria for inclusion. First, students who missed ⅓ or more of

the weekly SRL diary tool (n = 22) were excluded from analysis because weekly concurrent data from these students was too sparse to examine patterns in their psychological well-being, academic engagement, or goal attainment. Second, students were excluded from analysis if 50% or more of their weekly SRL diary tools were completed within 1 hour or less since this activity required them to plan for, conduct and then reflect upon a 1-2 hour academic study session. The remaining 118 students fit these criteria. Participants had a mean age of 19.12 years, 58% of students were female, 70% were first year students, and 90% of students reported English was their first language.

Data

SRL Diary Tool

The purpose of the weekly SRL diary tool was to encourage students to commit to one study session per week and practice engaging in a self- regulatory cycle to plan for, reflect on, and learn from each study session. Diary tools are a useful instrument for measuring SRL over time because they can help students raise their metacognitive awareness of their studying (Schmitz et al., 2011). A narrative response constructor in the weekly diary tool prompted students to identify and reflect on a main challenge encountered that week (see Figure 2).

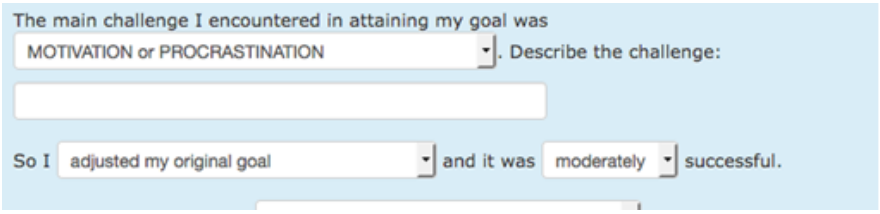


Figure 2. Items assessing students' metacognitive awareness of their weekly main challenge and their regulatory response to that challenge.

Students completed the SRL diary tool in two parts, planning and reflecting. In the planning session, the academic engagement and PWB measures create an opportunity for students to do an overall check-in on themselves for the previous week. To compute the group mean academic engagement and PWB scores, weekly scores for students were averaged to compute one within-person average for each student, and these scores were averaged to create the group grand mean.

For the academic engagement measure, students answered six questions either yes or no about their engagement in all their academic courses for the past week (see Appendix A). Items 1-4 captured four aspects of behavioural engagement and items 5 and 6 captured cognitive engagement. Cronbach's alpha was .64 for the academic engagement scale (see Fredericks et al., 2004). The psychological well-being measure (see Appendix A) was adapted from Rush & Grouzet (2012) and has 10 items where students rated each item on a 6-point Likert scale from 1 not at all to 7 very much. Cronbach's alpha was .85 for the PWB scale in this study.

Indicators of SRL

This study uses students' goal attainment and the challenge and strategy reflection as indicators of SRL. For goal attainment, each week after completing the 1-2 hour study session, students reflected on their self-set goal and indicated if they (a) did attain, or (b) did not attain their goal. For analysis, a score of 1 was used to indicate the goal had been attained and 0 was used to indicate it had not. Taken from previous research on goal attainment in the online SRL diary tool (Hadwin et al., 2019), we divided students up into three groups based on their goal attainment score which was calculated by the proportion of weeks the goal was reported to have been attained. Natural breaks in the histogram of goal attainment proportions (see Figure 3) resulted in three groups: (a) low/moderate attainers reporting attaining goals 33-78% of the time (n = 49), (b) high attainers reported attaining goals 86-89% of the time (n = 32), and (c) always attainers reported attaining their goals 100% of the time (n = 37). Descriptives for the three groups are reported in Table 1.

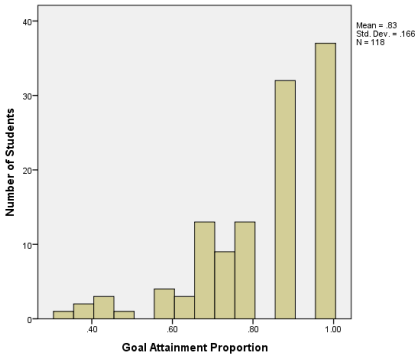


Figure 3. Histogram of within-person mean proportion of self-set goals reported attained over nine weeks used to create three goal attainment groups.

Table 1
Descriptives for the three goal attainment groups

Goal Attainment Group	n	Overall PWB mean(SD)	Final Exam	Final Course Grade	Overall Academic engagement
Low/Moderate	49	45.27(8.77)	72.88(11.91)	73.62(10.46)	4.38(.76)
High	32	47.73(8.75)	72.59(16.82)	74.07(10.84)	4.87(.57)
Always	37	51.64(6.48)	71.89(14.35)	73.88(7.78)	5.15(.55)
Overall	118	47.93(8.49)	72.49(14.03)	73.83(9.73)	4.75(.73)

For challenges and strategies, these lists were generated after reviewing and categorizing open ended text-based challenge statements and strategies identified by students in earlier iterations of the course (Hadwin et al., 2019). For analysis purposes, challenges were grouped into 10 distinct categories including: (a) motivation, (b) planning, (c) strategy, (d) cognition, (e) environment, (f) vocabulary and expression, (g) culture, (h) emotion, (i) mental health and well-being, (j) health and wellness, and (k) other challenge not in the list. Rather than asking about specific techniques or tactics (e.g., highlighting, elaborative interrogation, etc), strategy choices focused on types of regulatory actions. For analysis purposes, strategies were grouped into 9 categories including: (a) persisting, (b) goal management, (c) strategy adjustment, (d) help seeking, (e) emotion regulation, (f) changing effort, (g) task understanding, (h) passive strategies, and (i) other strategy.

Academic Performance Variables

Two academic performance variables were computed for the three groups. Students' final course grade reflects comprises coursework completed during the semester of the learning-to-learn course, including a final exam. The final exam tested students on their knowledge of course concepts through multiple choice questions and was worth 25% of their final course grade. Grades on both items could range from 0% to 100%.

Procedures

All procedures were approved by the institution's Human Research Ethics Board and all students used in data consented to participate through implied consent by enrolling in the course and not withdrawing from the research study. There was no incentive for consenting to participate in the research. Data were collected as part of regular course activities graded for participation but

not for content. Participants completed part of the weekly SRL diary tool in their lab section and finished them independently for homework before the next lab meeting.

Results

RQ1: Does PWB differ between groups of students with varying goal attainment?

In examining the groups for differences in PWB, the low/moderate goal attainment group had the lowest PWB score of the three groups and was significantly different only from the always goal attainment group (see Table 4). PWB was positively correlated to academic engagement (r = .605, $p < .001$) and goal attainment (r = .414, $p < .001$), meaning that higher levels of PWB were associated with higher levels of academic engagement and goal attainment. Academic engagement was positively correlated to goal attainment (r = .538, $p < 0.001$), meaning that higher levels of academic engagement were associated with higher levels of goal attainment. A one-way analysis of variance (ANOVA) determined there were significant differences between the three goal attainment groups for PWB (F (2,115) 6.497, p = .002). This corresponded to an effect size of η^2 = .10 indicating 10% of the variance in PWB scores was predictable from goal attainment group membership. A Tukey post hoc test (α = .05) revealed the PWB score was significantly lower for the low/moderate goal attainment group (M = 45.27) than the always goal attainment group (M = 5.15). The high goal attainment group (M = 47.73) did not differ significantly from either group.

Table 2
Mean PWB scores for each goal attainment group

Group Name	n	Mean PWB (SD)	95% CI	Minimum	Maximum
Low/Moderate	49	45.27(8.77)	42.75-47.79	26.50	63.75
High	32	47.73(8.75)	44.57-50.88	29.56	60.00
Always	37	51.64(6.48)	49.48-53.80	40.29	67.11
Overall	118	47.93(8.49)	36.39-49.48	26.50	67.11

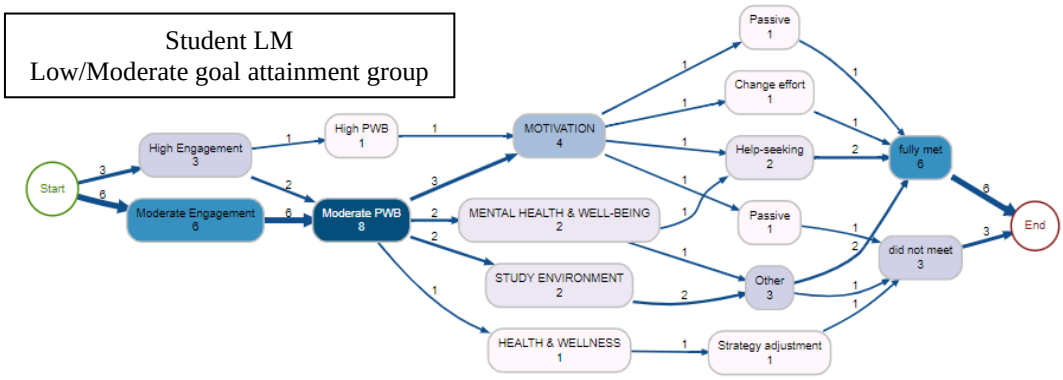
RQ2: How do patterns of regulation over the semester differ between a student who consistently attains weekly study goals (i.e., high goal attainment) and a student who does not (i.e., low-moderate goal attainment)?

The ANOVA established differences between the PWB of the low/moderate group and the always goal attainment group. Next, we examined within-person patterns of PWB, academic engagement, and SRL for two sample students. Process mining is a new method used to gain insight

into students' regulatory patterns and processes (see Bannert et al., 2013). Previous research has used process mining maps to aggregate student data by groups, but they can also be used to map individual students' data over time to uncover patterns representative of dominant student profiles (e.g., Rogiers et al, 2020). Due to the highly individualized nature of the online SRL diary tool, we did not have expectations of "correct" sequences of student responses. For example, if a student reported a motivation challenge, there are several strategies they may have chosen rather than only one correct strategy to choose. Thus, we did not aggregate students' process mining maps but rather we chose one student from each group whose individual mean of PWB was the closest to the group mean and created a process mining map for each of these students. We hypothesized these students would show different patterns of regulating their learning over time. Videos 1 and 2 show the process mining maps for student LM (mean PWB = 45.22) from the low/moderate group and student AL (mean PWB = 51.89).

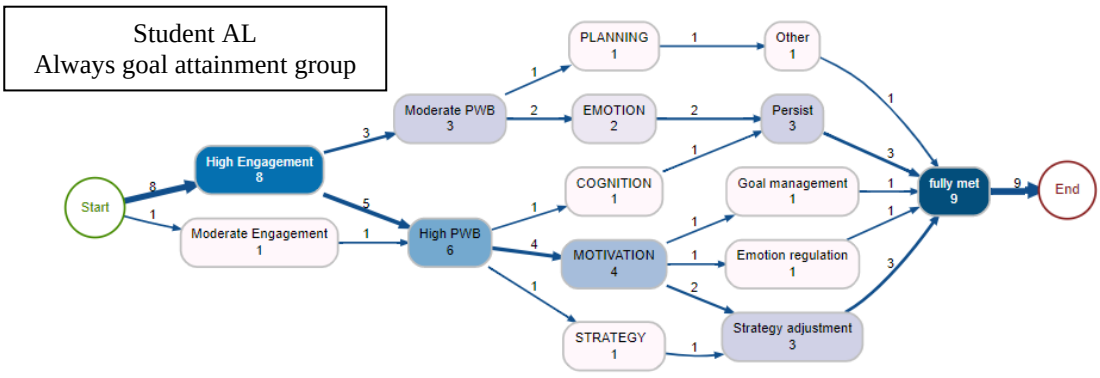
The process mining maps show each student's self-reported academic engagement, PWB, and challenge (in capital letters), and strategy selected each week in over nine weeks. PWB mean scores were divided into three categories: low PWB = 10-30, moderate PWB = 31-50, and high PWB = 51-70. Academic engagement was also divided into three categories: low engagement = 1-2, moderate engagement = 3-4, and high engagement = 5-6. Challenges are in capital letters and challenges and strategies were grouped according categories outlined in 3.2.2 in this paper. As seen in the dynamic version of the map (see Video 1), each moving dot indicates the sequence of the four categories as selected each week by the student and the 9 weeks appear simultaneously. The green dot indicates the goal was attained and the red dot indicates the goal was not attained. Hovering over the dot will reveal the week of each individual dot. The darker blue colour of the box indicates the higher frequency of selection by the student and the numbers by the lines between boxes indicate the number of times a path occurred. For example, for Student LM, at the start of the video, the 3 weeks where the student had high engagement, the student attained all their goals. Student LM's most common challenge was motivation (n = 4) and the most common path was between

moderate engagement and moderate PWB (n = 6). In Student AL's video (see Video 2), the video shows frequent high engagement with all goals attained. Student AL's most common challenge (n = 4) and the most common path was between high engagement and high PWB (n = 5).



Video 1. Process mining map for Student LM from the low/moderate goal attainment group *(see attached file Video_1_Student_LM to view the dynamic version of this map)*

Student LM from the low/moderate group began the course with high engagement and PWB, but strategy choices of passive and help-seeking led to frequent motivation challenges, leading to moderate engagement and PWB toward the end of the course (see Video 1). Student AL from the always group also began the course with high engagement and PWB, but the strategy choice of persist led to moderate PWB (see Video 2). When strategy, motivation, or cognition were the dominant challenges, strategies chosen by Student AL led to high engagement, followed by high PWB toward the end of the course.



Video 2. Process mining map for Student AL from the always goal attainment group *(see attached file Video_2_Student_AL to view the dynamic version of this map)*

Discussion

This study aimed to examine the interplay between PWB and SRL as students plan for and reflect on their approaches to attaining self-set academic goals over nine consecutive weeks. We used both between-person and within-person approaches. Two main findings from this study are highlighted: (a) students' between-person PWB differs according to self-reported goal attainment, and (b) students' within-person patterns of regulatory responses provide insight into the interplay between PWB and SRL. This study found students who reported always attaining their goals had higher PWB than students who reported low/moderate levels of goal attainment. This is consistent with Boudreaux & Ozer's (2012) finding that students who have high goal attainment both report success in pursuing multiple goals and have high life satisfaction and positive affect (i.e., emotional well-being). The finding from this study adds to the student success literature that students who always attain their self-set study goals also have high PWB. Feeling purpose in life and attaining goals is a part of the six dimensions of PWB (Ryff & Singer, 1998). Similarly, from an SRL perspective, attaining self-set goals indicates students are regulating their learning effectively. We did not specifically examine students' task perceptions or quality of the goals students' attained, two essential aspects of the phases of regulating learning (Hadwin & Winne, 2012), therefore future research could examine how task perceptions and subsequent goal attainment are implicated in both academic engagement and PWB.

Our second main finding was within-person patterns of PWB and academic engagement over time may affect regulatory responses to challenge or vice versa. Regulatory responses in this study comprised the challenges and strategies students reported while attempting to attain self-set goals. Previous research examining SRL and mental health at one time point also found students with better mental health had a mastery-approach goal orientation (Howell, 2009). Examining the process maps of Student LM and Student AL indicates PWB and engagement may be interacting with challenges and strategies. For example, Student LM seemed to try a variety of strategies when they had a motivation challenge but continued to have motivation challenges during the semester,

ending with moderate engagement and PWB compared to the start of the semester. Student AL also experienced motivation challenges but tried several other strategies and in turn experienced high engagement and high PWB consistently throughout the semester. Drawing on these findings, does high engagement or PWB fuel regulatory responses or do regulatory responses fuel high engagement or PWB? As SRL processes and strategies change over time and within-person, future research should continue to examine SRL and PWB or mental health as within-person processes. This will also allow for robust interventions based on students' individual patterns, rather than comparing students to each other.

Implications

In SRL, metacognitive awareness is central to learning and student success. At university, students must contend with multiple goals (e.g., academic, social, financial) to attain success. This study contributes to theory by indicating high PWB may be advantageous for students regulating their learning, or vice versa. Personal growth, life purpose, and autonomy are some of the dimensions of PWB (Ryff & Singer, 1998), therefore these larger-grained states may be important for students to be aware of as they attempt to regulate their learning, specifically around challenges. Due to the paucity of research on mental health and SRL, there are many opportunities for future research to examine the interplay of SRL and PWB or mental health at university for student success. Importantly, as students may benefit from extending their metacognitive awareness to their engagement and PWB while learning, interventions should be designed with both students and researchers in mind.

By examining the process mining maps of two students, we were able to see patterns in students' PWB, engagement, challenges, and strategies over nine weeks. Molenaar et al. (2019) found providing elementary students with personalized visualizations based on their learning improved regulating practice behaviour, learning transfer, and relative monitoring accuracy. Thus, even though we did not show students their maps in this study, future research could show students their process mining maps of their learning. Importantly, this process needs to be supported by SRL

as performance feedback alone is not always sufficient for students to translate their data into increased engagement in SRL (Butler & Winne, 1995). For example, students may be able to realize they are not engaged in their courses or attaining their goals, or they may recognize their PWB is also lower, and select a course of action. Alternatively, if students realize their PWB is low, this could help them to see the connection between their PWB, engagement, and/or goal attainment. This metacognitive awareness could also help students employ different strategies, such as revisiting their task perceptions, or revising their goals. When students engage in weekly regulatory planning and reflection, assessing their own PWB and engagement may provide easy access for students to take this data, examine it, and make changes as necessary. Specifically, visualizations of adaptive and maladaptive regulation patterns, such as through process mining maps, may help students identify for themselves where and when to make changes.

Limitations

This study examined data from one semester of an undergraduate elective learning-to-learn course and may not be generalizable to other courses. Students in this course could have been actively making changes to their learning approaches, potentially affecting the findings. Future research could examine the interplay between PWB and SRL in other undergraduate courses to see how student' regulatory responses vary when they are not taking a course on how to effectively manage their SRL processes and strategies. Also, this study only examined one aspect of mental health, PWB, rather than all three aspects of psychological, social, and emotional well-being. Understanding students' PWB at university is a salient issue. However, as PWB is only one part of mental health, considering all aspects of mental health may further help students increase their self-awareness and success simultaneously. Future research could use a comprehensive mental health scale, such as the Mental Health Continuum-Short Form (MHC-SF; Keyes, 2009) to investigate further the interplay between the three factors of mental health and SRL. Next, only two students' process maps were examined for within-person differences. This limits the generalizability of the findings but does create opportunities for designing

visualizations to assist students who are trying to improve either their learning approaches, their PWB and/or mental health, or both. This study relied on self-reported data only. This is important as this data can be useful for students to reflect on their own learning, but future research should incorporate objective data (e.g., trace data) to triangulate results. In particular, we relied on students' self-reported data of their goal attainment and even students in the low group were reported attaining goals most of the time (see Figure 3). While students' perceptions of their own learning are salient in SRL and student success, triangulating other objective goal attainment data would be prudent. Finally, the very moderate reliability for the academic engagement measure, indicating there may be a large error variance. The purpose of this measure was a weekly checklist where students could indicate whether they engaged in the specific behaviour (e.g., attended classes), however caution should be exercised in interpreting the findings of this measure due to the measurement error present.

Conclusion

In sum, to tackle the bigger issue of mental health at university, this study indicates students who report attaining their goals more often also have higher PWB. Leveraging SRL processes and strategies around academic challenges may also help students' PWB and engagement or vice versa. As engagement and PWB fluctuate over time, being aware of regulatory patterns may help students engage in more metacognitive control and strategic action. This is because, for students to be active in their SRL, they need ways to record and track data about their learning in order to identify patterns, monitor their approaches, and make adaptations as necessary (Winne, 2005). Self-regulating learners already regulate their behaviour, cognition, motivation, and emotion to reach goals (Winne & Hadwin, 1998), therefore extending their metacognitive awareness and control to their PWB may also be advantageous for student success. Finally, analyzing within-person patterns of PWB and SRL processes may offer the most opportunity for interventions with high utility and applicability by students to be successful at university.

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Appendix A: Measures

Academic engagement items

Item	Response
I attended all classes in my courses	Yes/No
I met all my deadlines in all my courses	Yes/No
I did all my assignments in my courses	Yes/No
I completed all the assigned readings in my courses	Yes/No
I asked for help when I didn't understand something in my courses	Yes/No
I tried to summarize what I learned in my courses	Yes/No

Psychological well-being items (adapted from Rush & Grouzet, 2012)

How am I doing this week?	**Likert Scale**
I feel grounded in who I am and where I am going	1 Not at all 4 Moderately 7 Very much
I feel supported by people in my life and classes	
I am engaged and interested in my activities	
I have encouraged people in my life and classes	
I feel competent and capable in my activities	
I feel alive and energized	
Life is good	
I feel successful in my courses	
I am successfully adapting to new challenges	

Appendix C2: Paper 2

Davis, S. K., Milford, T. M., & MacDonald, S. W. S. (2019). Examining associations over time between psychological well-being, academic engagement, and goal attainment. *Manuscript in submission.*

Examining within-person associations over time between psychological well-being, academic engagement, and goal attainment

Sarah K. Davis, Todd M. Milford, and Stuart W. S. MacDonald

University of Victoria

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Abstract

Previous research has determined that students with better overall mental health employ more self-regulated learning (SRL) strategies, and have higher academic functioning and self-reported grades (Howell, 2009), with higher student psychological well-being linked to improved goal attainment and engagement (Davis & Hadwin, 2019). Despite this knowledge, research on SRL and mental health is in a nascent stage as few investigations have examined (a) students' psychological well-being (PWB) during a semester in a university context, or (b) within-person coupled-change associations between students' PWB and regulatory patterns spanning numerous assessments across a university semester. In this study, 138 university students in a learning-to-learn course completed 9 weekly entries in an online SRL diary tool to plan for and reflect on a study session. Multilevel coupled-change models, exploring within-student associations between PWB and academic engagement, goal attainment, goal satisfaction, and rating of mental health challenge, revealed PWB shifts in positive association over time with academic engagement and rating of mental health challenge, but not goal attainment or satisfaction. Further implications for theory, research, and practice are discussed.

Keywords: Goal attainment, mental health, postsecondary education, psychological well-being, self-regulated learning

Examining associations over time between psychological well-being, academic engagement, and goal attainment

Self-regulation of learning at university is a key component of student success. When students self-regulate their learning, they exercise strategic control over their behaviour, motivation, emotion, and cognition to reach academic goals (Usher & Schunk, 2018; Winne & Hadwin, 1998; Zimmerman, 2000, 2008). From a self-regulated learning (SRL) perspective, there are many constraints or challenges affecting students' attempts to attain academic goals. For example, their attempts may be facilitated or constrained by cognitive strategies (Winne, 2014), help-seeking (Karabenick & Gonida, 2018), motivation regulation and strategy use (Wolters, 2003), self-evaluative standards, (Labuhn et al., 2010), students' beliefs about learning (Bjork et al., 2013), task understanding (Greene et al., 2012; Oshige, 2009), emotion regulation (Järvenoja et al., 2017; Webster & Hadwin, 2015), and student engagement (Edwards et al., 2017). Notably, students' mental health represents an under-explored constraint that may also affect how students regulate their learning.

This area of research is timely: student mental health is garnering more attention globally with research examining why mental health issues are increasing among postsecondary students around the world (American College Health Association, 2019; Holm-Hadulla & Koutsoukou-Argyraki, 2015; Macaskill, 2012). Accordingly, mental health support at postsecondary institutions is growing but recommendations or programs typically focus on out-of-classroom environments (e.g., Council of Ontario Universities, 2017; Storrie et al., 2010). Preventative programs in higher education should comprise universal mental health promotion programs and intensive reactive services (EENET, 2015). This study

contributes to this growing area of research by focusing on the under-examined associations between mental health and SRL in a university setting.

Mental Health at University

Mental health concerns represent a common rationale given by students who drop out of university (Conley et al., 2015). The most common complaints of students to counselling centers on campuses are anxiety, depression, low self-esteem, alcohol and substance abuse, and suicidal thoughts (Kreß et al., 2015). Two general categories of programs offered on campuses are (a) psychoeducational programs providing students with information about commonly encountered challenges (e.g., loneliness, anxiety, depression) at university as well as coping strategies to address these challenges, and (b) skills training programs emphasizing behavioral or cognitive-based behaviour techniques such as relaxation, mindfulness, and conflict resolution to address stress (Conley et al., 2015). Limited mental health promotion programs target the role student learning challenges play in mental health (e.g., Council of Ontario Universities, 2017), even though learning related challenges are dominant in higher education (e.g., Clark, 2005; Porter & Umback, 2019). Fostering mental health at university is paramount because “bringing about well-being -- positive emotion, engagement, purpose, positive relationships, positive accomplishment -- may be one of our best weapons against mental disorder” (Seligman, 2008, p. 5).

Defining Mental Health

Mental health is a state of well-being where individuals realize their potential, cope with normal life stressors, contribute to their community, and work productively (WHO, 2016). Mental health affects everyone at all times. Mental illness is a separate, yet related construct to mental health (Keyes, 2003). A mental illness is “a syndrome characterized by

clinically significant disturbance in an individual's cognition, emotion regulation, or behavior that reflects a dysfunction in the psychological, biological, or developmental processes underlying mental functioning" (APA, 2013, p. 12). Symptoms of these disorders, such as anxiety disorders or depression, must be present for a certain period of time and diagnosed by a qualified professional, such as a psychiatrist. Globally, the World Health Organization (2016) estimates one in four people will be affected by a mental illness during their lifetime.

Keyes' Mental Health Model

Keyes' (2002) conceptualization of mental health has been adopted worldwide (see Keyes, 2013) and with different age groups (e.g., Peter et al., 2011; Suldo & Shaffer, 2008). This model emphasizes that mental health and mental illness do not exist as opposite ends of a single continuum, but rather as distinct, correlated axes suggesting mental health is a separate state from mental illness (see Figure 1; Keyes, 2013). Individuals can be categorized by both their mental illness status and their level of mental health. Mental health consists of a set of symptoms comprising emotional, psychological, and social well-being and can range from flourishing to languishing. Individuals with flourishing mental health (a) experience positive emotions toward life, (b) function well both psychologically and socially, (c) have excellent emotional health, (d) miss few days of work or school, and (e) do not have physical limitations in their daily lives (Keyes, 2003). One study showed prevalence rates among 1200 Canadian university students' mental health, where 24.2% were flourishing, 67.2% had moderate mental health, and 8.7% were languishing (Peter et al., 2011). Situating mental health in a well-known empirically-based framework such as Keyes' (2002, 2005) recognizes there are multiple types of well-being under the umbrella of mental health. Promoting mental

health at university has the potential to not only prevent mental illness (Seligman, 2008), but to also foster adaptation and resilience through overcoming challenges to student success.

Figure 1. Keyes' dual-continua model of mental health (2013). Figure from "Promoting and protecting positive mental health: Early, and often throughout the lifespan," by C. L. M. Keyes in C. L. M. Keyes (Ed.), *Mental well-being: International contributions to the study of positive mental health* (p. 17), 2013, Netherlands: Springer. Copyright 2013 by C. L. M. Keyes. Reprinted with permission.

University Student Success

Defining postsecondary student success is usually situated at the institutional level (i.e., graduation, retention; Tinto, 2006). We posit situating student success at the individual level where success is indicated by students attaining their self-set goals (Davis & Hadwin, 2019). Previous research on challenges that postsecondary students face is usually situated in the larger-grained category of student retention rather than the finer-grained level of individual student success. For example, community college students reported challenges with balancing work/school, finances, relationships, and health and disabilities (Porter & Umback, 2019). The main challenges reported by university students are similar to college (e.g., two-year institution) students: classes, professors, academic responsibilities, grades,

extracurricular activities, studying, and relationships (Clark, 2005). In a study of the main reasons first year students report withdrawing from university, academic challenges and low-quality learning experiences represent two of the top seven responses (Yorke & Longden, 2007). Thus, students across types of postsecondary institutions report challenges to their learning, and these learning challenges may put students at risk for dropping out of university. Students need mental health promotion programs that not only raise awareness of mental health, but also equip students with the knowledge as to how to effectively regulate their learning around challenges.

Self-Regulated Learning

SRL has been researched in educational settings for over forty years (Schunk & Greene, 2018). Rooted in cognitive-behavioural, cognitive-developmental, cognitive-metacognitive, and social-cognitive perspectives, SRL provides an integrative lens to examine the complexities of learning. When students self-regulate their learning, they take control of their motivation, behaviours, and affect in pursuit of their learning goals (Schunk & Greene, 2018; Zimmerman, 1986; 1990; Zimmerman & Schunk, 1989). SRL models (a) recognize the overlapping roles of metacognition, cognition, motivation, and emotion, and include planning, performance, and reflection in their models (see Panadero, 2017 for a review), and (b) assume students have the potential to monitor, control, and regulate their learning (Pintrich, 2004).

The SRL model framing this study, the Winne and Hadwin (1998) 4 phase model, is a loosely sequenced, recursive cycle comprising task perceptions, goal-setting and planning, strategic enactment, and large-scale adaptation. Task perceptions, the first phase, is where students are prompted to think about the explicit, implicit, and/or sociocontextual aspects of

the task (Hadwin & Winne, 2012). The next phase, goal-setting, is most productive when task perceptions are clear and the goal focuses on the process of learning (e.g., comparing and contrasting course content) rather than the outcome of learning (e.g., grades). Strategic enactment, the third phase, is where students select strategies based on their knowledge of the task and their goal. The final phase, large-scale adaptation is an optional phase that may occur when students reflect on their learning. In this phase, students may make changes to their learning approaches if they gained information during the previous phases they interpreted to be important and/or more effective than previous approaches. These 4 phases are guided by metacognitive monitoring and evaluating which are at the center of this model and may occur during students' engagement in any of these phases. These metacognitive processes are informed by metacognitive knowledge, or knowledge about thinking (Winne, 2017) that students collect during learning.

Situating learning in the Winne and Hadwin (1998) model highlights the cyclical, adaptive, recursive nature of learning, particularly in university. Students in university must set and maintain finer-grained and larger-grained goals to be successful. For example, students must regulate finer-grained goals such as completing readings, assignments, attending classes, as well as regulating larger-grained goals such as completing a prerequisite course, managing working a part-time job with studying, and financial goals. This model accounts for the types of goals students set and attain (or not attain) on a regular basis and provides a framework in which to operate, and recognizes students face a wide range of challenges during the process of goal attainment. When students are successful (i.e., attaining their self-set learning goals), these processes and strategies may go underground and be

subconscious. However, especially in university, many students experience challenges during SRL.

SRL and Challenges

One of the main principles of self-regulating learning is attaining self-set goals, thus SRL is integral to student success at the finer-grained individual level at university. Goals in SRL encapsulate effective learning: better goals focus on learning skills and competencies, not the tasks themselves (Schunk & Greene, 2018). Students realize a challenge is occurring when their metacognitive monitoring and/or evaluating reveals current strategies or tactics are not working toward the attainment of their learning goals (Hadwin et al., 2019). Students experience diverse challenges in university; however, all types of challenges provide opportunities for students to actively and strategically regulate their learning (Hadwin et al., 2011). However, in order to self-regulate their learning, students need to be actively engaged in the learning process. Learners who self-regulate are successful because they draw from a wide range of strategies to navigate challenges arising during daily tasks and activities as they attempt to reach their goals (Hadwin & Winne, 2012). By framing SRL in Winne and Hadwin's (1998) four-phase model, these challenges may arise during any one of the phases and will usually be identified through students' metacognitive monitoring and/or evaluating of their progress.

When students fail to self-regulate their learning, they report encountering challenges (e.g., motivation and beliefs, planning and goal-setting, well-being, emotion, cognition) that interfere with goal-setting and attainment for weekly course-based studying and task work (Hadwin et al, 2019). Importantly, these challenges disrupt goal progress varying from student to student due to individual differences, such as well-being, and students may not

have the skills or strategies to cope with these new demands. For example, when students are concerned about their well-being during a task, they may need to increase their cognitive processing capacity to return their focus back to the task (Boekaerts, 1993). This could limit students' resources to use strategies or adapt their approaches. Further, goals, commitments, and beliefs vary both between and within individuals based on the appraisals they make of situations and how these appraisals may affect their well-being (Lazarus & Folkman, 1984).

SRL and Mental Health

Research on SRL processes and strategies to attain goals is burgeoning, however, little is known about the role that mental health plays in goal attainment and engagement in SRL processes and strategies. Students' engagement with goal-setting and planning are vital to well-being because attaining goals contributes to well-being (Macleod et al., 2008). Previous research indicates students with flourishing mental health had the highest levels of adaptive academic functioning and were more likely to use SRL strategies than students who were languishing (Howell, 2009). Additionally, students' use of motivation regulation strategies may be effective in reducing procrastination and raising performance and well-being (Grunschel et al., 2016). However, these previous studies relied on measures of both SRL and mental health at but a single time of assessment and thus emphasized between-person comparisons.

Differences on the relation between mental health or well-being and academic performance are mixed. Previous findings show students with higher mental health have higher self-reported semester grades (Howell, 2009). However, Davis and Hadwin (2019) found no differences in the final grade of one course between students with higher psychological well-being during a semester compared to students with lower psychological

well-being. Moving away from whether mental health predicts academic performance to examining mental health and SRL processes over time recognizes both mental health and SRL are dynamic within-person processes that fluctuate over time. Although, mental health is clearly implicated in SRL, however current research is only starting to examine this implication in detail. As such, other areas of research may provide information on how mental health is implicated in goal attainment.

SRL and Psychological Well-Being

In examining the three factors of Keyes' (2005) mental health model, similarities can be drawn particularly between psychological well-being (PWB) and SRL (Davis & Hadwin, 2019). PWB represents eudaimonic well-being, or positive functioning, and consists of self-acceptance, personal growth, life purpose, environmental mastery, autonomy, and positive relations to others (Keyes, 2013). Engaging in SRL processes and strategies relies on self-reflection, goals, beliefs, autonomy, and managing complex environments therefore, they may be concern that there is overlap between PWB and SRL. However, this does not mean there is redundancy in examining the interplay (Howell, 2009). Davis and Hadwin (2019) found students who reported always attaining their goal during one university semester, had higher PWB and engagement than students who reported lower levels of goal attainment. However, these findings were aggregated for one semester and not examined week by week. Thus, as PWB fits under the umbrella of mental health, PWB may be particularly salient in the goal attainment process for students as they regulate their learning and engagement over time at university to be successful.

Student Engagement

Just as SRL requires students to be actively engaged in the learning process, student engagement is a multi-dimensional, malleable pathway to vital educational outcomes, such as grades (Reeve, 2013). Defining student engagement varies across disciples (e.g., Azevedo, 2015; Eccles, 2016), and within a SRL framework, student engagement captures how students report engaging with their studies at university. Fredericks et al.'s (2004) commonly cited student engagement framework defines student engagement as how students engage their behaviour, cognition, and emotion in educational environments. Students who are behaviourally engaged attend and participate in classes and complete assignments and tasks. Cognitive engagement includes the use of learning strategies to be successful around academic tasks (Reeve, 2013). Finally, emotional engagement includes students' interest, belonging, and enjoyment in education. Student engagement in both the processes and outcomes of learning predict student achievement and performance (e.g., Fredericks et al, 2004; Reeve, 2013), particularly with cognitive and behavioural engagement. Research indicating a clear link between high emotional engagement and high academic performance are mixed. There are some indicators that experiencing more positive activating emotions (e.g., enjoyment) are associated with higher performance (e.g., Pekrun & Linnenbrink-Garcia, 2012). However, Edwards et al. (2020) found higher performing students experienced more negative activating and deactivating emotions than lower performing students. Thus, the relation between emotional engagement and academic performance may be less straightforward than cognitive and behavioural engagement.

In addition, Kahu (2013) outlines four perspectives for research on student engagement: behavioural, psychological, socio-cultural, and holistic. The behavioural

perspective is the most widely accepted view of engagement and emphasizes the interactions between student learning and teaching practices (e.g., Chickering & Gamson, 1987; Kuh et al., 2007). The psychological perspective considers how the three dimensions of behavioural, cognitive, and affective engagement (i.e., Fredericks et al., 2004) overlap over time, and how they vary in intensity. The socio-cultural perspective situates individual students' experiences within the larger social context. Finally, the holistic perspective considers how a cluster of institutional factors affects student engagement (i.e., behaviour, cognition, and affect).

Examining students' mental health and their use of SRL processes and strategies can be done within the context of the institution, but first we must increase our understanding of the associations at the student level. In addition, "engagement is fundamentally situational—it arises from the interplay of context and individual" (Kahu, 2013, p. 763). Thus, selecting measurement approaches that take this interplay into consideration are crucial.

Measuring SRL, Engagement, and Mental Health

As research on students' PWB, engagement, and SRL processes over time is in a nascent stage, initial exploration of linkages between students' self-reports of mental health and learning has the potential to inform theory, research, and practice. Gathering self-report data in SRL research has moved from considering SRL as an aptitude (e.g., by using the MSLQ; Pintrich et al., 1991) to focusing on events using finer-grained measurements of learning, for example a single two-hour study session (e.g., McCardle et al., 2015). Finer-grained measures aim to capture students' intents and reflections on their SRL processes and strategy use, recognizing that SRL is cyclical, adaptive, recursive, and as a result, may not look the same for each student, task, time, and/or context. Criticisms of this approach in SRL research emphasize using a self-report measure "casts an adaptive, on-the-fly behavior as a

homogeneous, static state" (Winne, 2014, p. 275). However, what students intend to do while learning is critical as students can examine their own patterns of learning through event-based data collected from self-report measures. If self-report measures used are sensitive to the fluctuations over time between PWB, engagement, and SRL to understand their interplay, they are particularly well-suited to this line of inquiry.

SRL Diary Tools

One example of a self-report tool that both measures and helps develop SRL is the diary tool. SRL diary tools create an opportunity for students to plan for a study session and reflect on their use of SRL processes and strategies when faced with a learning challenge. Diary tools are useful for measuring SRL over time, improving transfer, and improving metacognition and motivation in small increments in skill improvements (Schmitz et al., 2011). Objectives of diary tools can include fostering student' reflections on the content they are learning or on their own learning behaviour (Fabriz et al., 2014). Diaries focusing on learning behaviour ask students questions about their learning processes and can be structured by using questionnaires. Previous research has determined that diary tools are more successful in contexts where students are also learning about effective SRL strategies and processes (Fabriz et al., 2014). Also, students who completed an SRL diary intervention had a positive effect on students' metacognitive skills, metacognitive attitude, and time management compared to the control group (Dignath-van Ewijk et al., 2015). Finally, diary tools are also useful in the context of students learning to regulate their learning because these tools can capture the process of learning while making that data useful to the students, the instructors, and researchers.

However, relying on data from SRL diary tools is not without limitations. For example, diary data relies on self-report and high compliance from students which can reduce external validity of the SRL diary data if only highly motivated students are represented in the data (Schmitz et al., 2011). If SRL diary tools are completed before, during, and/or after the behaviour (e.g., reflecting on their goal attainment process after a study session) occurs in a real learning situation, then ecological validity should be high. This is an important consideration because every learning instance is an opportunity for students to collect data about themselves and their learning (Winne, 2005). SRL diary tools are not only completed before, during, and/or after a learning session, but all data collected can help students monitor and reflect on their progress, identify challenges, and make changes as needed. With these strengths and limitations in mind, SRL diary tools offer rich data captured around learning situations that can be useful for students to aggregate so they can reflect on their approaches.

Additionally, we hypothesize analyses to examine the interplay between SRL, PWB, and engagement using SRL diary tool data, would benefit from using a combination of between-person analyses and within-person analyses focusing on associations over time. Previous research on SRL and mental health or PWB and SRL have mainly focused on learning data derived from one timepoint (e.g., Howell, 2009), and focused on between-person comparisons (e.g., Grunschel et al., 2012). PWB has been determined to have higher within-person variance than between-person variance (see Rush & Grouzet, 2012), and measurement approaches should consider this variance. Finally, previous research often treats engagement as a mediator of social, cognitive, and affective outcomes, however, engagement is more than a mediator, and is a phenomenon worth examining on its own

(Krause & Coates, 2008). Adding to the body of research on mental health and SRL more broadly may benefit from analytic approaches that take into consideration the potential complexities of this interplay.

Purpose and Research Questions

A paucity of research has examined (a) within-person fluctuations in students' PWB across one semester in a university context, as well as (b) whether a robust within-student association between PWB and regulatory patterns can be documented over the course of a semester (e.g., on assessments when a given student's PWB is higher than usual, what are their regulatory patterns?). Thus, the purpose of this study was to examine the between- and within-person interplay of PWB and SRL processes at university. This study aims to fill that gap in the literature by employing multilevel models to explore within-person coupled change in an intensive repeated measures design. There were three research questions:

1. Between students, how do the process variables of PWB, academic engagement, goal attainment, goal satisfaction, and mental health and well-being challenge predict academic performance in one course and in one semester?
2. How much variance in weekly PWB scores across a university semester is systematically between- vs. within-person?
3. Within students, can coupled-change associations across the semester be clearly demonstrated between PWB and ratings of academic engagement, goal attainment, goal satisfaction, and mental health and well-being challenge?

For RQ1, we hypothesized the process variables would not be significant in predicting academic performance due to the difference in granularity between a process variable

measured weekly compared to an end of semester grade or overall GPA. For RQ2, based on the findings of Rush and Grouzet (2012) where they found 62% of the variance on the PWB measure was within-person, we hypothesized the within-person variance on the PWB measure will be higher than the between-person variance. Finally, for RQ3, we hypothesized there would be clear coupled-change associations between PWB and the other process variables.

Methods

Participants

Consenting participants included 140 students enrolled in one section of an undergraduate elective learning-to-learn course at a Canadian comprehensive university in the fall semester of 2017. Two students were excluded from analyses due to no data submitted in their diary tools, resulting in a final sample size of 138. Participants had a mean age of 19.12 years and 58% of students were female. Students were from a range of faculties within the university, 70% were first year students, and 90% of students reported English was their first language.

Research Context

The learning-to-learn course is a semester-long elective primarily taken by first year undergraduate students at all achievement levels enrolled in at least one other academic course concurrently. Students learned about Winne and Hadwin's (1998) SRL model and how to apply SRL processes and strategies to their other courses. Each week there was one 90-minute lecture and one 90-minute lab in which students applied lecture material. Other topics covered in the course included procrastination, motivation and emotion, time management, test anxiety, and collaboration. During this course students learned about and

applied a variety of regulatory skills, strategies, and beliefs meant to improve their approaches to learning.

Procedures

Procedures were approved by the institution's Human Research Ethics Board and all students used in data consented to participate through implied consent by enrolling in the course and not withdrawing from the research study. There was no incentive for consenting to participate in the research. Data was collected as part of regular course lab activities which were graded for participation but not for content.

Variables

Variables in this study are divided into two categories: process variables were collected weekly for nine weeks, and academic performance variables are the grades students received for one course, and for the semester.

Process Variables

Data for this study came from an online SRL diary tool (Hadwin, Miller, & Webster, 2012; McCardle et al., 2015; Webster & Hadwin, 2015) completed as a part of the learning-to-learn course in the fall semester of 2017. Students received a weekly mark for completing the weekly diary tool but were not marked on their answers. The purpose of the diary tool was to encourage students to commit to one study session per week and practice engaging in a self-regulatory cycle to plan for and reflect on each study session. Students completed the first part of the diary tool (i.e., planning) during the lab section of the course, and completed the second part of the diary tool (i.e., reflecting) on their own time after completing the single study session.

Planning. The first two variables are from the planning section of the online SRL diary tool: (a) a 10 item measure of psychological well-being, and (b) a 6 item measure of academic engagement (see Appendix A for all questions included in the online SRL diary tool).

Psychological Well-Being. The psychological well-being measure was adapted from Rush and Grouzet (2012) and has 10 items where students rate each item on a 7-point Likert scale from 1 not at all to 7 very much. Cronbach's alpha for the PWB measure in this study was .85.

Academic Engagement. Based on previous research for this course which found differences in engagement predicted performance in the course (Edwards et al., 2017; Davis et al., in press), this measure was added to the diary tool in this semester. Students answered six yes or no questions about their engagement in all their academic courses for the past week, for example whether they attended all their classes, submitted all their assignments, or asked for help when needed (see Appendix A). Items 1-4 captured four aspects of behavioural engagement and items 5 and 6 captured cognitive engagement (see Fredericks et al., 2004). This is in line with Krause and Coates (2008) definition of engagement which focuses on the behavioural and cognitive aspects of engagement. Using a binary response scale facilitated easier interpretation of the items for students; for example, students either attended all their classes or they did not, students completed all their readings or they did not. Cronbach's alpha for the academic engagement scale in this study was .64.

Reflecting. The second group of variables comes from the reflection section: (a) a goal attainment rating, (b) a goal satisfaction rating, and (c) rating of how much their mental health and well-being was a challenge each week.

Goal Attainment. Similar to the binary response scale used for the academic engagement measure, students made a judgment as to whether they attained their goal with 0 = did not attain the goal and 1 = did attain the goal. Other research has used a Likert scale to evaluate goal attainment (e.g., a 9-point Likert scale from the self-concordance model; Sheldon & Elliott, 1998). However, one of the goals of the SRL diary tool is to have students engage in SRL processes and use metacognition to reflect on their progress, thus having this item be binary requires students to make a judgment about whether they attained their goal. Subsequent sections in the diary tool have students answer more questions about why they think they did or did not attain the goal.

Goal Satisfaction. One of the questions where students had to rate their satisfaction using a Likert scale with their goal progress was goal satisfaction. Students rated their satisfaction with their goal progress on a 4-point Likert scale, with 0 = not at all, 1 = minimally, 2 = moderately, and 3 = completely.

Weekly Rating of Challenges. In the diary tool, students rated how much each of 12 challenges negatively affected them overall that week (see Hadwin et al., 2019 for full list of challenges). The only challenge used in the current analysis was the rating of mental health and well-being (MHWB) challenge. Students rated how much of a challenge their mental health and well-being was on a 6-point Likert scale from 0 = not applicable this week to 5 = negatively affected me this week. Examples listed for students for this category were sick/tired or not eating well, not enjoying being at university, family and relationship issues, feeling stressed and overwhelmed most days, and not feeling in control of my life. For analysis, the scales for these items were reverse coded so that 5 represented “not applicable this week” and 0 represented “negatively affected me this week”. This ensured parallel

interpretation across variables where a higher rating indicates students' MHWB was less of a challenge that week.

Academic Performance Variables

Overall Course Grade. Students' course grade reflects overall performance in the learning-to-learn course and comprised coursework and a grade on a final exam taken at the end of the semester. Grades could range from 0% to 100%.

Semester GPA. Students' semester GPA was obtained by institutional data in the subsequent semester. The university uses a nine-point GPA scale, where 0 = E (0-49%), 1 = D, (50-59%), 2 = C (60-64%), 3 = C+ (65-69%), 4 = B- (70-72%), 5 = B (73-76%), 6 = B+ (77-79%), 7 = A- (80-84%), 8 = A (85-89%), and 9 = A+ (90-100%).

Analyses and Findings

Analyses in this study used both the within- and between- person analyses. For research question 1, multiple regression was used to predict academic performance from the five process variables. For the within-person analyses used in research questions 2 and 3, multilevel modelling analyses were used because this data is nested as there are repeated measurements (i.e., 9 weekly MyPlanners) nested within individuals (i.e., the students). Additionally, the focus was on the process-based model of intraindividual change, or the weekly fluctuations of students' PWB and how PWB was associated with other variables, rather than focusing on developmental changes over time in PWB. This approach is less frequently used but emphasizes how different variables travel across time together within individuals (Sliwinksi & Mogle, 2008). Time in these models is considered a proxy that could potentially be eliminated by instead focusing on other processes causing change in individuals (e.g., cognitive, psychosocial). In SRL research, learning is process-based as

students regulate myriad processes and this study aimed to add PWB to these processes. Therefore, multilevel modelling is a suitable approach for this longitudinal data because (a) PWB can be expected to vary significantly across students (see Peugh, 2010), and (b) failing to consider the between-person and within-person variation of students' PWB may lead to biased results and/or potentially inaccurate conclusions about within-person variance over time (Hoffman & Stawski, 2009). HLM 7.03 software was used for all multilevel analyses (Raudenbush et al., 2017).

For research question 2, intraclass correlations were calculated for each variable. For research question 3, coupled-change models between within-person PWB and each of the other variables revealed whether changes in one variable correspond to another variable's changes for any student (Sliwinski & Mogle, 2008). This approach assumes changes in the dependent variable (i.e., PWB) are not only due to time but also as a function of the predictor variables' changes over time. This approach is in contrast to correlated change models, where individuals' scores on one variable change more rapidly than on other variables.

For the coupled-change models in RQ3, all models were compared to the baseline model (equation 1). The baseline model shows the PWB score for person i at time t, β_{0i} is the mean of PWB when time is zero for person i, β_{1i} is the effect of time on PWB for person i, $TIME_{it}$ is time represented by weeks 1-9 centered at 0, and r_{it} is the residual for person i. Level 2 represents the within-person variance on the intercept and slope from level 2.

Level 1: $PWB_{it} = \beta_{0i} + \beta_{1i}\,(TIME_{it}) + r_{it}$ (1)

Level 2: $\beta_{0i} = \gamma_{00} + u_{0i}$

$\beta_{1i} = \gamma_{10} + u_{1i}$

Model 1 is a coupled-change model between PWB and academic engagement score, a time varying predictor (see equation 2). The equations for models 2 to 4 can be seen in Appendix B. Level 1 of model 1 shows the PWB score for person i at time t, β_{0i} is the mean of PWB when Time is zero for person i, β_{1i} is the effect of time on PWB for person i, $TIME_{it}$ is time represented by weeks 1-9 centered at 0 for person i, β_{2i} is the coupling parameter, and r_{it} is the residual for person i.

Level 2 of model 1 has intercept γ_{00} as the mean of PWB when time = 0 controlling for academic engagement; γ_{01} is the level 2 effect of between-person differences in academic engagement; u_{0i} is the random effect for each person for PWB, γ_{10} is average time slope of PWB controlling for academic engagement; u_{1i} is the random effect for each person for the time slope of PWB; and, γ_{20} is the relative within-person effect of academic engagement on variation in PWB. More specifically, γ_{20} is the coupled-change interaction term. Parameters were estimated using full information maximum likelihood.

$$\text{Level 1: } PWB_{ti} = \beta_{0i} + \beta_{1i}\left(TIME_{ij}\right) + \beta_{2i}\ (AcaEng_{ij} - PMAcaEng_i) + r_{it} \quad (2)$$

$$\text{Level 2: } \beta_{0i} = \gamma_{00} + \gamma_{01}(PMAcaEng) + u_{0i}$$

$$\beta_{1i} = \gamma_{10} + u_{1i}$$

$$\beta_{2i} = \gamma_{20}$$

RQ1: Between students, how do the process variables of PWB, academic engagement, goal attainment, goal satisfaction, and mental health and well-being challenge predict academic performance in one course and in one semester?

Descriptives for all variables in this study are shown in Table 1. Correlations between the process variables and academic performance indicated overall course grade is only

related to academic engagement, goal attainment, and mental health and well-being challenge whereas semester GPA is related to all five variables (see Table 2).

Table 1

Descriptives for all variables

Variable	N	Minimum-Maximum	Mean (SD)	Skewness (SE)	Kurtosis (SE)
Process variables: Planning					
PWB	139	26.50 – 67.11	47.31(8.50)	-.278(.206)	-.200(.408)
Academic engagement	139	2.80 - 6.00	4.65(.77)	-.446(.206)	-.550(.408)
Process variables: Reflecting					
Goal attainment	140	0 – 1	.777(.224)	-1.405(.205)	2.194(.407)
Goal satisfaction	138	0 – 3.00	2.15(.491)	-.926(.206)	1.911(.410)
MHWB challenge	138	0 – 5.00	2.79(1.06)	-.219(.206)	-.004(.410)
Academic performance					
Overall course grade	139	38.80-90.20	71.78(11.16)	-.668(.206)	.295(.408)
Semester GPA	138	.00-8.00	4.47(1.90)	-.175(.206)	-702(.410)

Note: The mean for the process variables is the within-person mean across nine weeks of the semester; PWB=psychological well-being, MHWB=mental health and well-being, and GPA = grade point average

Table 2

Correlations between process variables and academic performance variables

Variable	1	2	3	4	5	6	7
1. Academic engagement							
2. Psychological well-being	.552**						
3. Goal attainment	.528**	.396**					
4. Goal satisfaction	.392**	.541**	.675**				
5. Mental health and well-being challenge	.345**	.549**	.407**	409**			
6. Overall course grade	.213*	.134	.316**	.166	.175*		
7. Semester GPA	.294**	.191*	.328**	.210*	.206*	.481**	

Note. Within-person means for variables 1-5 were used; PWB=psychological well-being, and MHWB=mental health and well-being; * indicates $p < .05$. **indicates $p < .01$.

Multiple regression analysis was used to test if the within-person means of the five process variables (i.e., academic engagement, PWB, goal attainment, goal satisfaction, and MHWB challenge) significantly predicted overall course grade and/or semester GPA. The results of the regression predicting overall course grade indicated the five predictors explained 11% of the variance in overall course grade (R^2=.110, F(5,131)=3.25, p = .009), however none of the five predictors were significant. The results of the regression predicting semester GPA indicated the five predictors explained 13.2% of the variance in semester GPA (R^2 =.132, F(5,130)=3.963, p = .002), with goal attainment as a significant predictor (β = .247, p = .048).

RQ2: How much variance in weekly PWB scores across a university semester is systematically between- vs. within-person?

Calculating the intraclass correlations (ICC) determined the between-person and within-person variance for all variables. The ICC for PWB determined 63% of the variance in PWB was between-person and 37% was within-person. The equations for the fully unconditional models for each variable appear in Appendix B. The within-person variance ranged from 37% for PWB to 87% for goal attainment (see Table 3). As the outcome variable PWB had an ICC of 37%, the design effect was calculated to be 3.33, which exceeds the minimum requirement of 2 to warrant use of MLM (Muthén & Satorra, 1995).

Table 3
Unconditional models for all variables

Parameters	Unconditional PWB Model (outcome variable)	Unconditional academic engagement model	Unconditional goal attainment model	Unconditional goal satisfaction model	Unconditional MHWB challenge rating model
Regression coefficients (fixed effects)					
Intercept (γ_{00})	47.31(.72)**	4.67(.06)**	.79(.02)**	2.17(.04)**	2.79(.08)**
Variance components (random effects)					
Residual (σ^2)	38.80(1.74)	.97(.04)	.14(.01)	.512(.02)	1.18(.05)
Intercept (τ)	66.99(8.66)	.46(.07)	.02(.004)	.14(.02)	.88(.13)
Intraclass correlation between person	63%	32%	13%	21%	43%
Within-person variance	37%	68%	87%	79%	57%
Model summary					
Deviance statistic	7687.51	3387.98	1112.98	2561.85	3502.53
Number of estimated parameters	2	3	3	3	3

Note. Parameter estimate standard errors listed in parentheses; * p <.05, ** p<.01.

RQ3: Within students, can coupled-change associations across the semester be clearly demonstrated between PWB and ratings of academic engagement, goal attainment, goal satisfaction, and mental health and well-being challenge?

With the aim of further examining the within-person variance in PWB, comparing the models revealed all coupled-change models accounted for more of the within-person variance in PWB over time than just the time change model alone. Table 4 details how each coupled-change model accounts for more variance than the time change model. Calculating the pseudo-R squared for each model revealed model 1 (i.e., the coupled-change model with PWB and academic engagement) and model 4 (i.e., the coupled-change model with PWB and MHWB challenge rating) were significantly associated over time. Model 1 with accounted for 31% more variance, and model 4 with MHWB challenge rating accounted for 27% more variance. Conversely, model 2, the coupled-change model with PWB and goal attainment, accounted for 18% more variance in PWB. Model 3, the coupled-change model with PWB and goal satisfaction, accounted for 28% more variance in PWB. However, neither of these models were significantly associated with PWB over time. Chi square analyses between the time change model and the other models determined there was no significance difference in the deviance statistic, or in other words, the other models did not significantly improve upon the initial model with PWB and time. The coupled-change model with academic engagement accounted for the most variance by accounting for a total of 42% of the within-person variance in PWB over time.

Table 4

Comparison of psychological well-being coupled-change model summaries

Parameters	Baseline Model	Model 1	Model 2	Model 3	Model 4
	Time change model	Coupled-change model with academic engagement	Coupled-change model with goal attainment	Coupled-change model with goal satisfaction	Coupled-change model with MHWB challenge rating
Regression coefficients (fixed effects)					
Intercept (γ_{00})	48.411(.73)**	20.75(3.65)**	33.16(2.95)**	26.69(2.97)**	35.90(1.76)**
Person mean of variable from column heading (γ_{01})	-	5.93(.75)**	18.14(3.47)**	10.03(1.29)**	4.39(.55)**
Time (γ_{10})	-.30(10)**	-.29(.09)*	-.28(1.03)*	-.29(.10)*	-.25(.10)*
Coupled change estimate (γ_{20})	-	2.07(.25)**	.99(.47)	.27(.27)	1.22(.24)**
Variance components (random effects)					
Residual (σ^2)	32.15(1.55)**	29.07 (1.41)**	31.74(1.55)**	31.75(1.55)**	30.63(1.52)**
Intercept (τ)	60.92(9.02)**	41.77 (6.55)**	50.08(7.75)**	44.01(7.02)**	44.54(7.09)**
Model summary					
Deviance statistic	7611.38	7445.83	7459.53	7437.34	7201.43
Number of estimated parameters	6	8	8	8	8

*Note: Parameter estimate standard errors listed in parentheses; * p <.05, ** p<.01.*

The interpretation of the coupled change estimate(γ_{20}) for model 1 indicates on occasions when academic engagement is one unit higher than usual for a given individual, PWB increases by 2.07 (see Figure 2). Therefore, when students have higher than average academic engagement for a given week, their PWB that week is also higher. For model 4, on occasions when the MHWB challenge rating is one unit higher than usual for a given individual, the coupled change estimate (γ_{20}) for PWB increases by 1.22 (see Figure 3). Or,

on weeks when students rate their MHWB is less of a challenge than average, their PWB that week is also higher. These analyses were concerned with the within-person coupled change; therefore the level 2 between-person effect was not interpreted.

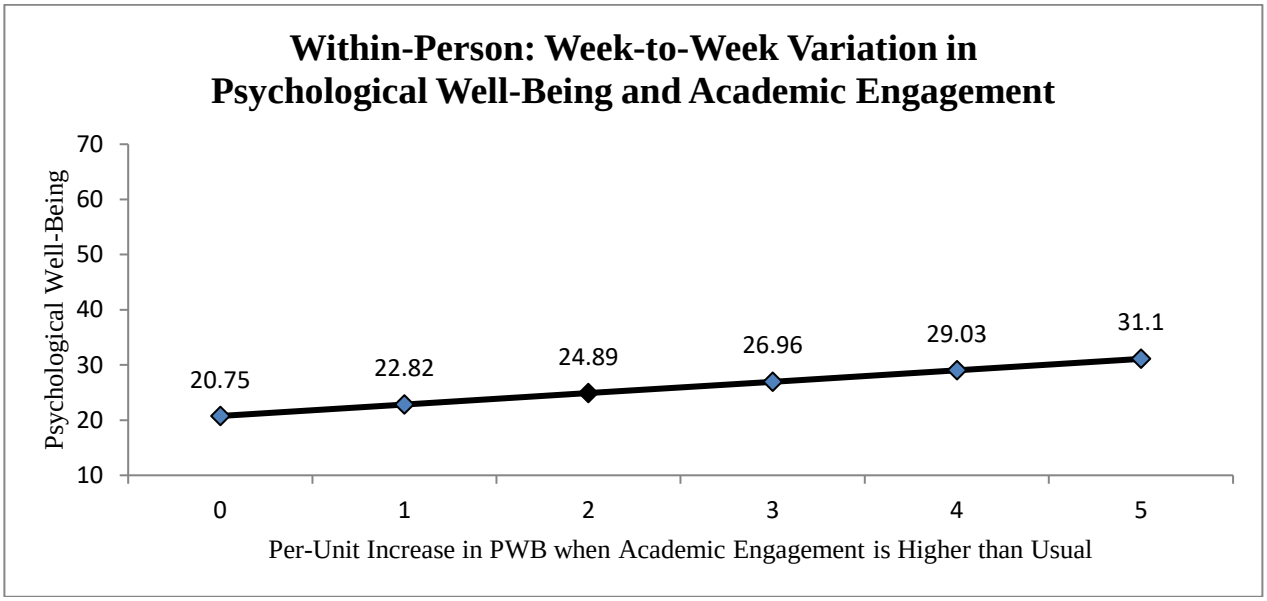

Figure 2. Interpretation of coupled change estimate for the within-person variation in PWB and academic engagement

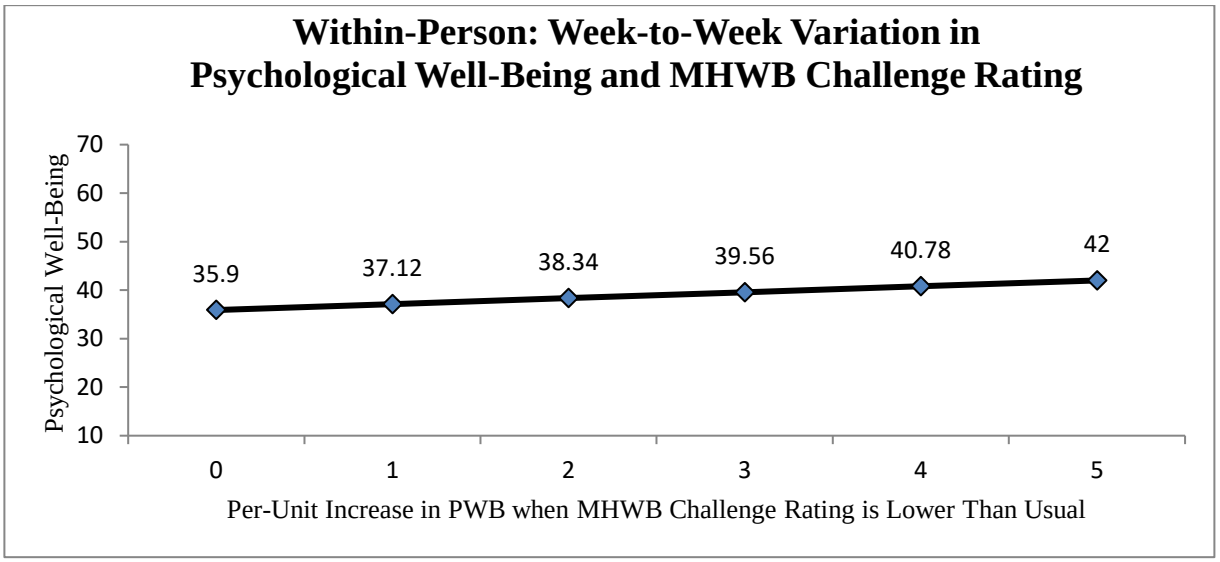

Figure 3. Interpretation of coupled change estimate for the within-person variation in PWB and MHWB challenge rating

Discussion

The purpose of this study was to examine the between- and within-person interplay of PWB and SRL at university. Students' responses in a weekly online SRL diary tool captured this self-report process data and was analyzed using multiple regression and multilevel coupled-change models. The findings from these analyses indicate: (a) the importance of between- and within-person methods in this line of research, (b) the coupled-change models show PWB shifts over time in association with PWB and with MHWB challenge rating, and (c) goal-setting and PWB needs further examination.

Using Between- and Within-Person Methods

In examining how the five SRL process variables predicted academic performance, only goal attainment was significant in predicting semester GPA. This finding supported our hypothesis that no process variables would predict overall course grade but did not support our hypothesis that no process variables would predict semester GPA. Next, PWB was not significant in predicting overall course grade or semester GPA (c.f., Howell, 2009). However, with 37% of the variance in PWB being within-person, findings support further examining the within-person variance in students' PWB during a university semester. Our hypothesis was not supported by this finding. Rush and Grouzet (2012) found 62% of the variance in psychological well-being using the same measure was within-person. Their study examined daily PWB for two weeks during the beginning of a semester, whereas this study measured weekly PWB over nine weeks of an entire academic semester, albeit with a lower 36% of the variance in PWB as within-person. The lower within-person variance could be due to the longer period of time in between measurements in this study. The studies that have examined SRL and PWB or mental health have done so at the between-person level, focusing

on the differences between students in PWB or mental health (e.g., Howell, 2009). This study contributes to the field by highlighting the importance of considering the within-person variance in PWB to be valuable information worth further investigation.

As for the other process variables, within-person variance was higher than PWB for rating of MHWB challenge (57%), academic engagement (68%), goal satisfaction (79%), and goal attainment (87%). From SRL theory, regulating goal attainment is key to student success. If student success is defined as when students attain self-set goals (Davis & Hadwin, 2019), then high within-person variance in measures of goal attainment support this conceptualization of success. Self-set study goals (i.e., a goal for a 1-2 hour study session in a diary tool) are set by individual students who also self-set the level of challenge of the goal, the quality, the priority, the importance, etc. And, goal attainment was significant in predicting semester GPA. Future research should examine (a) how mental health or PWB is specifically implicated during planning in SRL, and (b) how goal attainment contributes to academic performance.

Coupled-Change Models Show Association over Time

Coupled-change models were used for this analysis because they do not assume there is a developmental relation between the variables, rather, they identify how two variables shift in association over time with each other and whether that pairing is significant (Sliwinski & Mogle, 2008). These models provide information about the over time interplay between the variables in the model. Our hypothesis was partially supported by the findings from the coupled change models, however only two variables showed association over time with PWB instead of all four as we hypothesized.

Academic Engagement and PWB

Academic engagement and PWB shift over time in positive association with each other. This coupled-change model accounted for 42% of the within-person PWB variance over time. These findings build on previous research which found students with higher mental health and well-being used more SRL strategies, had higher academic functioning (i.e., low procrastination, growth mindset, higher self-control), and had higher self-reported grades (Howell, 2009). The positive association over time between academic engagement and PWB indicates regulating academic behaviour and cognitions (e.g., attending classes, doing assignments, etc.) at university is associated with higher PWB. When students have higher than average weekly PWB, they were also more academically engaged. This may suggest regulating PWB may have implications for engagement as regulating behaviour (e.g., engagement) at university is an important piece of SRL as students try to attain academic goals.

However, the coupled-change analysis does not indicate that having higher engagement *causes* higher PWB or vice versa, but that they shift over time in association with each other. This has important implications for future research on PWB, or mental health more broadly, and student engagement. This study considered student engagement from a psychological perspective (see Kahu, 2013) and asked students to self-report their behavioural and cognitive engagement, phrased around how they regulated their behaviour in completing academic activities (e.g., Krause & Coates, 2008). The PWB measure in the online diary tool assesses, among others, students' feeling of purpose, competence, vitality to represent their positive functioning. This study adds to research on student engagement and PWB by indicating this complex interplay is positively associated over time. Rather than

isolating engagement or PWB as a mediator or outcome, this interplay indicates the benefits of taking a within-person, over time measurement perspective. For example, students could evaluate their data from the online SRL diary tool to determine where they could improve their engagement, for example by attending all their classes, finishing their assignments, etc and then see if they seen an improvement in their PWB. Targeting their academic engagement (e.g., regulating their behaviour) is an important part of SRL and could have implications for students' PWB at the same time. Future research could examine this association through an intervention where students collect data on their PWB and academic engagement and use that data to guide future choices about their behaviour.

Mental Health and Well-Being Challenge Rating and PWB

Findings revealed on weeks when students' PWB was higher than average, they reported their mental health and well-being was less of a challenge. This finding echoes theory that everyone has mental health (Keyes, 2002). Students' perceptions of how much their MHWB is affecting them each week shifts with their weekly PWB score. Particularly in university during learning, PWB may be implicated the most often as aiming to reach one's potential, using one's strengths, and having a purposeful life raises PWB (Keyes et al., 2002). However, social well-being may be undermined in this process as social well-being in particular helps preserve positive feelings (i.e., emotional well-being) about life. Therefore, employing a comprehensive mental health measure, such as the 14-item Mental Health Continuum-Short Form (Keyes, 2009), in future research would (a) include an overall mental health score (i.e., flourishing, moderate, or languishing mental health), and (b) parse out the three factors of mental health, psychological, social, and emotional well-being in research with SRL. Additionally, looking for patterns in other challenges students may face (e.g.,

emotions, cognition, etc.) would provide more information about how certain challenges may be associated with mental health than others.

Goal-Setting and PWB Needs Further Examination

Whether students' goals were attained or students were satisfied with their goals did not shift over time with PWB. This could be due to the high amount of within-person variance in these two variables. In SRL, goals provide information about students' task understanding and direct planning and strategy choice (Winne & Hadwin, 1998). Goals also provide standards to which students can use to engage in monitoring and evaluating of their goal progress and satisfaction. Therefore, high levels of within-person variance in goal satisfaction and attainment are not surprising as goal-setting is dependent on a wide variety of individual contexts. One possible explanation there was not a shift over time with PWB is these items assessed students' perceptions of their attainment and satisfaction with their individually set goals, rather than the quality of the goal according to a research-informed criterion, for example whether or not the goals included *content* to be learned, *actions* to identify cognitive processes employed, *standards* for self-evaluation, and a *timeframe* to achieve the goal (CAST goals; McCardle et al., 2015).

Additionally, our findings are not in line with previous research (see Sheldon & Elliot, 1999) where a sequence of events around goals, including goal attainment and goal satisfaction, predict well-being (i.e., emotional well-being) in the self-concordance model. Sheldon and Elliot's (1999) model of self-concordance suggests there may be a direct path between goal attainment and changes in well-being and encapsulates the process from adopting a goal to attaining a goal and the corresponding effect on well-being. However, there are three distinct differences between this study and the self-concordance model that

may explain the contrasting findings. First, the goals students set in previous research were broad, semester long goals rather than goals for a 1-2 hour study session as in this study. Second, the measures used for goal attainment was a 9-point Likert scale rating on how well the students were doing on attaining their goals, rather than a binary yes or no response used in this study as to whether students attained the goal.

Third, this study was framed using SRL theory that recognizes students may regulate many components simultaneously during learning (i.e., cognition, motivation, behaviour, metacognition), therefore goal-setting and goal attainment is not viewed as a straightforward, linear process, in contrast to the self-concordance model. Rather, goal-setting and attainment takes place in recursive, cyclical phases and depends on accurate monitoring and evaluating to make progress. Therefore, future research should examine additional aspects of planning, such as task understanding or quality of goals set to find a within-person association over time with PWB and consider other types of data, for example trace data as to what students are doing when they are setting goals or think alouds around students' goal-setting.

Theoretical and Practical Implications

Findings from this study have implications for theory and practice of the interplay between SRL and mental health. In SRL theory, there is pre-existing support for the importance of well-being. Boekaerts' (2011) SRL model is the only model to explicitly mention well-being. This model comprises two pathways students can follow when they are self-regulating their learning, the mastery/learning pathway or the coping/well-being pathway. For example, when an individual observes a discrepancy between perceived task demands and resources to meet those demands, they may experience negative emotions, mood changes, and concerns about well-being (Boekaerts, 1993). This perception may

influence an individual to move along the coping/well-being pathway to preserve their well-being. If the individual perceives no threat to their well-being, they will proceed along the mastery/learning pathway instead.

However, Keyes' (2002, 2005) conceptualization of mental health states everyone has mental health all the time. Importantly, Boekaerts' (2011) model does not define well-being; therefore, it is unclear what factor(s) of mental health are being addressed. The findings from this study support students' PWB is not associated over time with goal attainment or satisfaction. Therefore, this study may indicate students' PWB are engaged in both the mastery/learning and coping/well-being pathways as PWB did not shift in association with whether students attained their goals or were satisfied with their goals. Using this model may require a shift to recognize students' well-being is always engaged, however there may be students' whose well-being is at risk but still choose the mastery/learning pathway. What implications does this carry for students' well-being during learning? What implications are there for students' well-being if they always choose the coping/well-being pathway?

Benefits of Using Winne and Hadwin's (1998) Model to Research SRL and Mental Health

Thus, framing research on mental health and SRL may benefit from using the Winne and Hadwin (1998) model, where the emphasis is on the processes used during learning and how metacognition can be used to draw students' monitoring and evaluating to these processes as needed. Rather than rely on pre-set or predetermined pathways for learning based on students' assessments of their PWB or mental health more broadly, one benefit of framing mental health research in this SRL model is students are active participants in their autonomous learning through metacognitive awareness of their learning. The benefit of

framing research on mental health and SRL in this model recognizes the importance of metacognition in SRL. By highlighting the metacognitive aspects of SRL occurring during and throughout every phase and PWB as a condition potentially carrying over to other phases, students using this model could monitor and evaluate their learning progress as well as potentially their PWB around setting goals and planning. Importantly, this is *not* to suggest SRL is a potential intervention for the treatment or diagnosis of mental illnesses; instead, perhaps the metacognitive aspects of SRL could provide opportunities for students to be prompted to think about their mental health before, during, or after learning along with their behaviour, cognition, motivation, and/or emotion, etc.

What Role Does Mental Health Play in SRL?

Further, this model describes the cognitive architecture of COPES occurring in each phase, conditions, operations, products, evaluations, and standards (Winne & Hadwin, 1998). Conditions can be internal or external about the task or oneself; the conditions occurring during phase one (i.e., task perceptions) have the potential to carry over to other phases through the products created in phase one and subsequent phases. Findings from this study showed that students' weekly PWB was not associated with goal attainment or satisfaction, but academic engagement and rating of MHWB challenge were. Therefore, it is possible PWB is a condition affecting students' learning at a larger-grained (i.e., weekly) level, but not at the finer-grained individual level of goals students aim to attain. However, there may be some influence of PWB, and all three factors of mental health, on other aspects of goal-setting, such as quality, priority, or confidence and this could be the topic of future research.

Finally, in order for students to be active in their SRL, they need ways to record and track data about their learning in order to identify patterns, monitor their approaches, and

make adaptations as necessary (Winne, 2005). Self-regulating learners already regulate their behaviour, cognition, motivation, and emotion to reach goals (Zimmerman, 2000, 2008), therefore extending their metacognitive awareness and control to their PWB or mental health may also help them reach academic success. Examining within-person patterns over time of mental health and SRL may offer the most opportunity for intervention. Campus based interventions could look at using research-proven SRL strategies and processes to optimize students' mental health in classrooms during learning, to complement existing programs emphasizing mental health literacy and promotion in out of classroom settings.

Limitations

This study examined data from one semester of an undergraduate elective learning-to-learn course and may not be generalizable to other courses. Students in this course could have been actively making changes to their approaches which may have affected the findings. However, for research on SRL, students learning to regulate their learning make ideal participants as they will exercise a larger variety of strategies and tactics than students developing SRL on their own (Winne, 2014). Future research could examine the interplay between mental health and SRL in other undergraduate courses to see how student' regulatory responses vary when they are not taking a course on how to effectively manage their SRL processes and strategies. Further, triangulating this data with trace data (e.g., Azevedo et al., 2007) and think alouds (e.g., Green & Azevedo, 2009) could help broaden research on this topic. In addition, multimodal data could capture both the process and structure of learning and potentially contribute to new theories of SRL (Reimann, 2019). It is important to recognize this line of inquiry is in its infancy, but new methodological approaches used in SRL research provide promise for future studies. Next, this study only

examined one aspect of mental health rather than all three aspects of psychological, social, and emotional well-being. While this study does contribute to the field of mental health research and SRL as some previous studies examined symptoms of mental illness and SRL (e.g., Brackney & Karabenick, 1995), this is a limitation.

This study focused on goals students set for a 1-2 hour study session and make a metacognitive judgment as to whether they attained the goal. When students are planning for a single study session, they may have several goals for that session rather than just one. However, the course context is a university course that teaches students how to self-regulate their learning to improve their university success so students are asked to only set one goal for one study session. In addition, our measure of academic engagement did not include affective engagement, which is a crucial part of student engagement (Fredericks et al., 2004) and SRL (e.g., Webster, 2019). The measure was a part of the online SRL diary tool where students rated their behavioural and cognitive engagement weekly. Previous research is mixed on whether experiencing more positive emotions or negative emotions is an indicator of student engagement (e.g., Edwards et al., in press). We ask students questions about their emotion regulation during the reflecting phase of the online SRL diary tool but did not include those results in this study. Future research could examine the coupled change associations between indicators of emotional engagement and mental health and/or SRL processes.

Finally, this study used a binary measure for goal attainment. Students are asked whether they attained their goal with yes or no. Other studies use multi point Likert scales to have individuals assesses the nuances in goal attainment (see Gillet et al., 2012). Having a multiple point Likert scale could affect the association between goal attainment and PWB

over time. Triggering students' metacognitive awareness by having students keep track of how many goals they are attaining could help them know when to adapt or seek help as goal attainment is significant for semester GPA.

Conclusion

In sum, this study contributes to the field by considering how the within-person fluctuations in PWB over time are associated with certain SRL processes. The findings raise important questions about the interplay between PWB and self-regulated learning, inform theory, and provide directions for future research. Self-regulating learning is not about the products of learning, but rather the processes and strategies engaged during learning. Adding PWB, and mental health more broadly, to research on the myriad processes shifting in association together to facilitate or constrain SRL is a promising new direction. Rather than adding to the list of mental health promotion programs on university campuses focused on out-of-classroom interventions, teaching and fostering SRL in university has the potential to provide students with more opportunities to be strategic, adaptive learners *and* foster flourishing mental health.

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Appendix A: Academic engagement and psychological well-being measures included in the online SRL diary tool and the online SRL diary tool

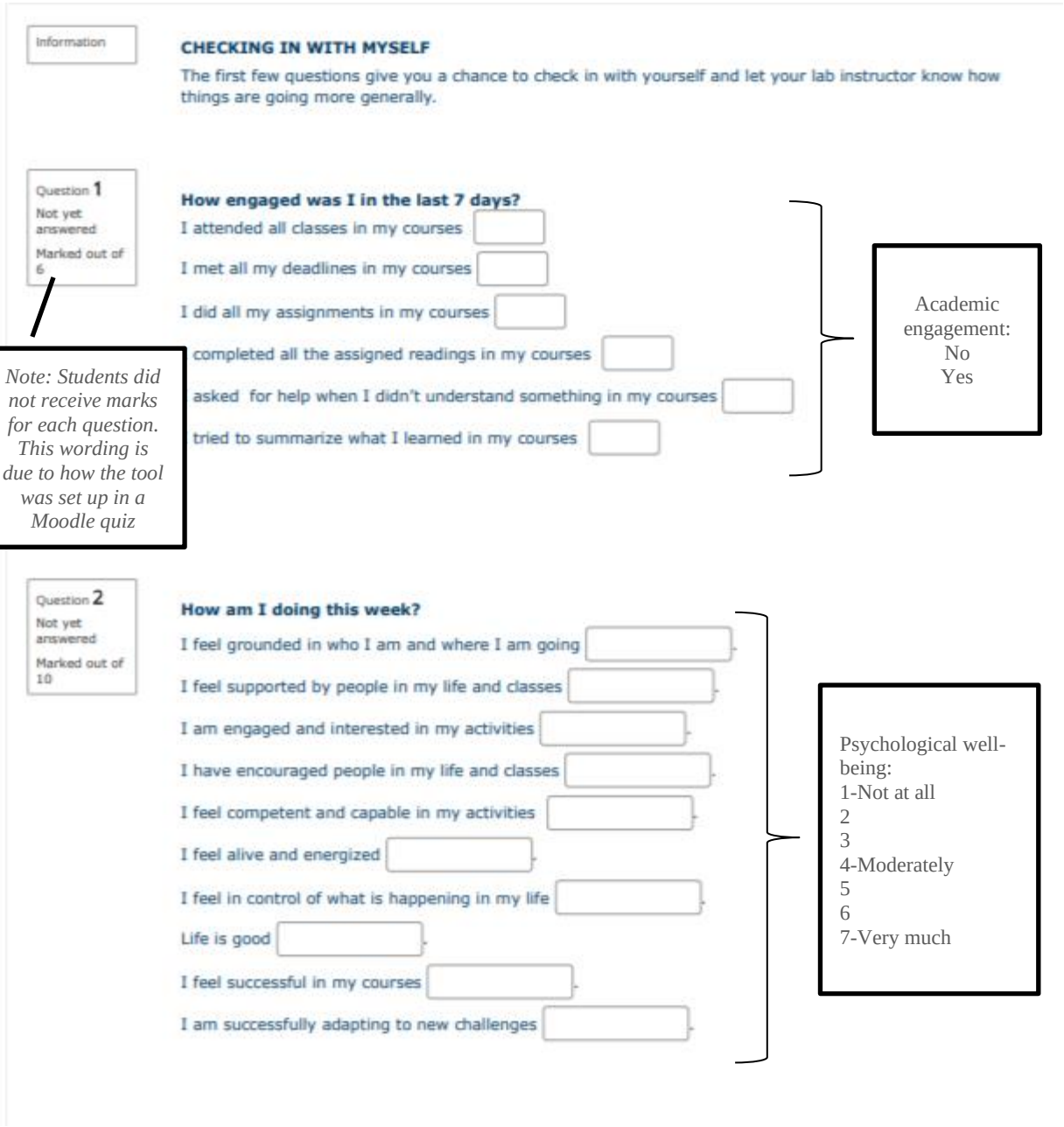
Academic engagement

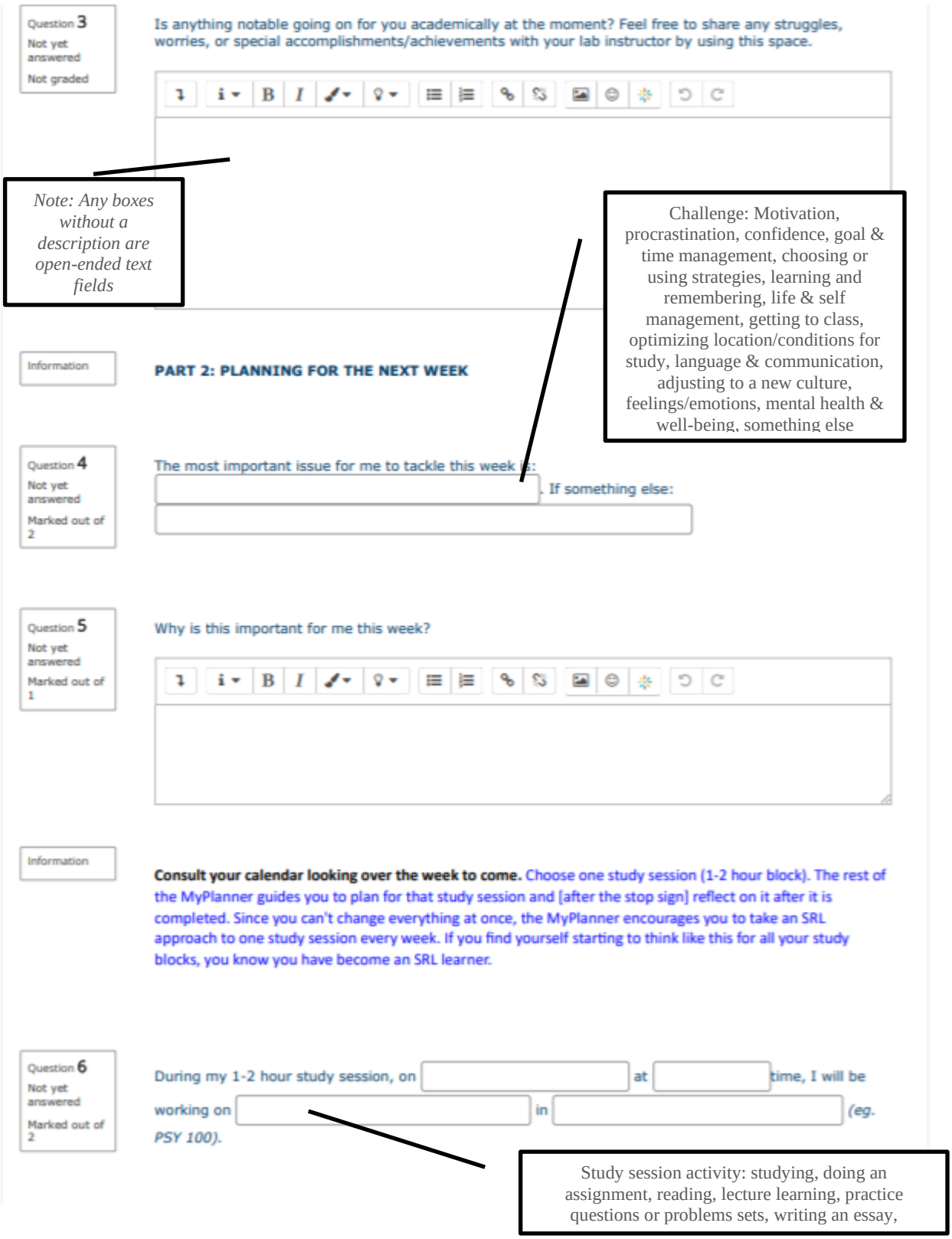
Item	Response
I attended all classes in my courses	Yes/No
I met all my deadlines in all my courses	Yes/No
I did all my assignments in my courses	Yes/No
I completed all the assigned readings in my courses	Yes/No
I asked for help when I didn't understand something in my courses	Yes/No
I tried to summarize what I learned in my courses	Yes/No

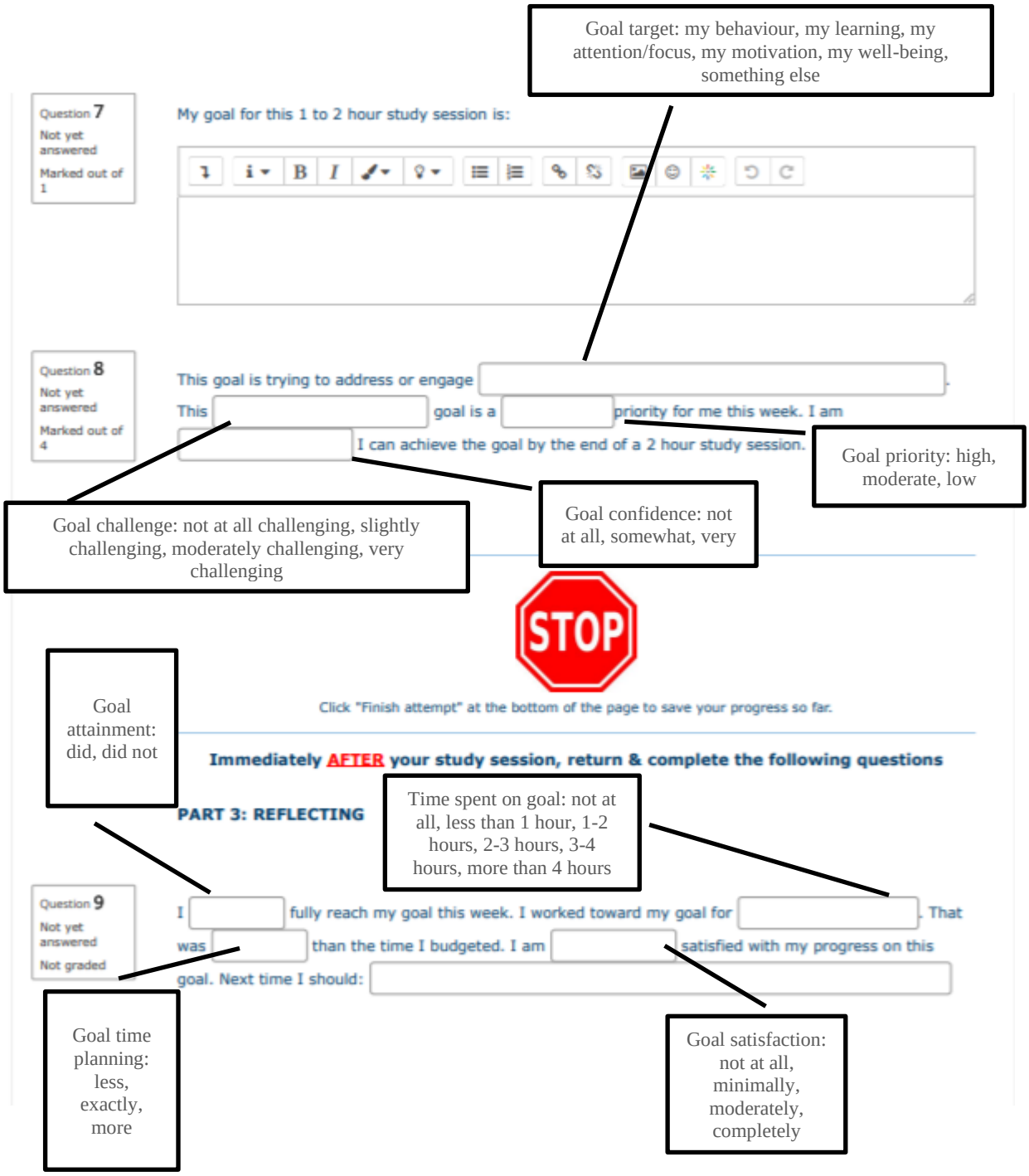
Psychological well-being items (adapted from Rush & Grouzet, 2012)

How am I doing this week?	**Likert Scale**
I feel grounded in who I am and where I am going	1 Not at all 4 Moderately 7 Very much
I feel supported by people in my life and classes	
I am engaged and interested in my activities	
I have encouraged people in my life and classes	
I feel competent and capable in my activities	
I feel alive and energized	
Life is good	
I feel successful in my courses	
I am successfully adapting to new challenges	

SRL Diary Tool (Hadwin et al., 2018)




Question 3
Not yet answered
Not graded
Is anything notable going on for you academically at the moment? Feel free to share any struggles, worries, or special accomplishments/achievements with your lab instructor by using this space.
Note: Any boxes without a description are open-ended text fields
Challenge: Motivation, procrastination, confidence, goal & time management, choosing or using strategies, learning and remembering, life & self management, getting to class, optimizing location/conditions for study, language & communication, adjusting to a new culture, feelings/emotions, mental health & well-being, something else
Information
PART 2: PLANNING FOR THE NEXT WEEK
Question 4
Not yet answered
Marked out of 2
The most important issue for me to tackle this week is:
. If something else:
Question 5
Not yet answered
Marked out of 1
Why is this important for me this week?
Information
Consult your calendar looking over the week to come. Choose one study session (1-2 hour block). The rest of the MyPlanner guides you to plan for that study session and [after the stop sign] reflect on it after it is completed. Since you can't change everything at once, the MyPlanner encourages you to take an SRL approach to one study session every week. If you find yourself starting to think like this for all your study blocks, you know you have become an SRL learner.
Question 6
Not yet answered
Marked out of 2
During my 1-2 hour study session, on
at
time, I will be working on
in
(eg. PSY 100).
Study session activity: studying, doing an assignment, reading, lecture learning, practice questions or problems sets, writing an essay,

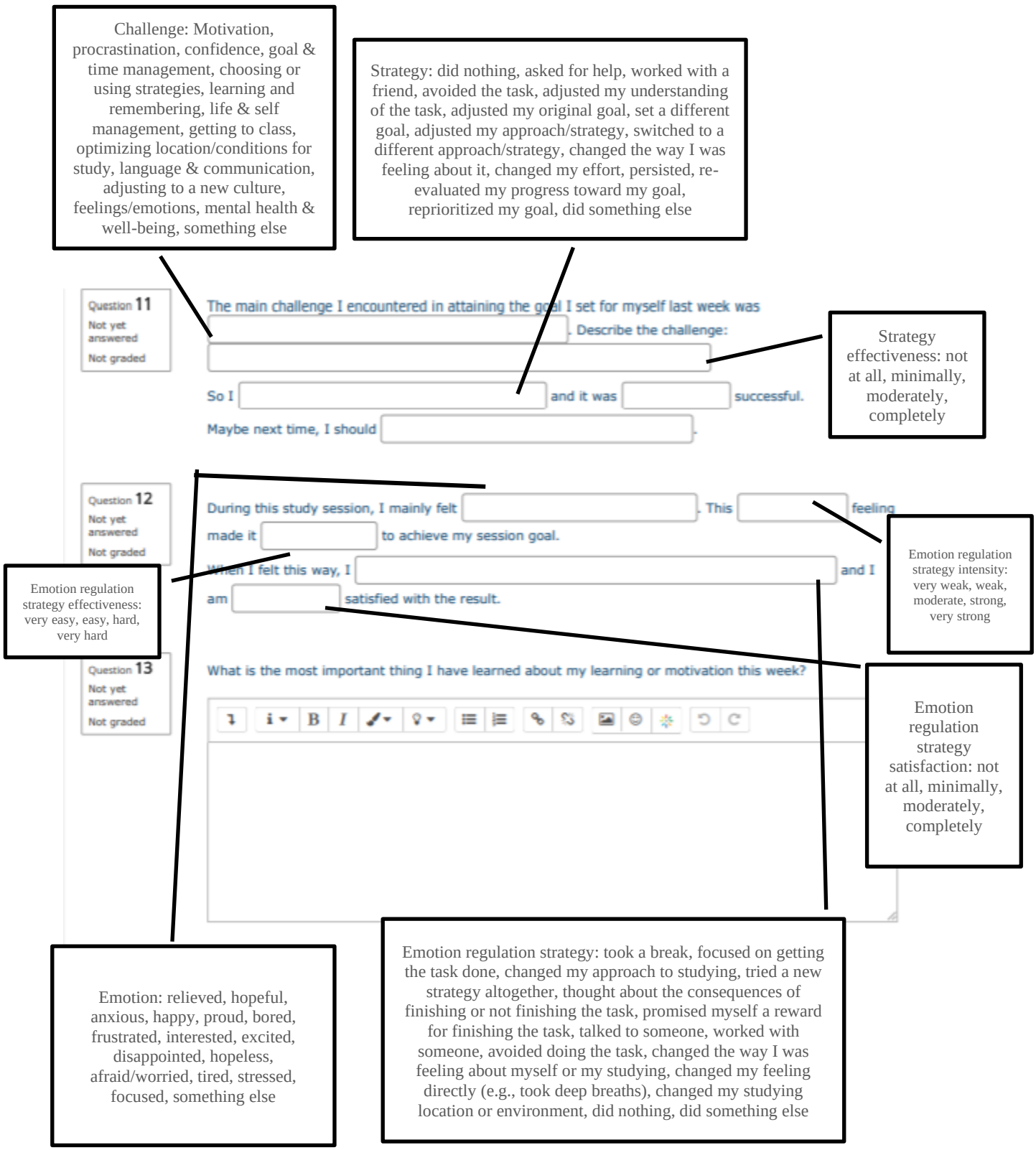

Goal target: my behaviour, my learning, my attention/focus, my motivation, my well-being, something else
Question 7
Not yet answered
Marked out of 1
My goal for this 1 to 2 hour study session is:
Question 8
Not yet answered
Marked out of 4
This goal is trying to address or engage
This
goal is a
priority for me this week. I am
I can achieve the goal by the end of a 2 hour study session.
Goal priority: high, moderate, low
Goal challenge: not at all challenging, slightly challenging, moderately challenging, very challenging
Goal confidence: not at all, somewhat, very
STOP
Click "Finish attempt" at the bottom of the page to save your progress so far.
Goal attainment: did, did not
Immediately AFTER your study session, return & complete the following questions
PART 3: REFLECTING
Time spent on goal: not at all, less than 1 hour, 1-2 hours, 2-3 hours, 3-4 hours, more than 4 hours
Question 9
Not yet answered
Not graded
I
fully reach my goal this week. I worked toward my goal for
. That
was
than the time I budgeted. I am
satisfied with my progress on this
goal. Next time I should:
Goal time planning: less, exactly, more
Goal satisfaction: not at all, minimally, moderately, completely

Question 10
Not yet answered
Marked out of 11

How much of a challenge were each of these during the last week?

CHALLENGES	MY RATING	EXAMPLES
Motivation & Procrastination *The will or desire to do my work*		Difficulty persisting Difficulty getting started Low interest or will Kept putting it off
Confidence *Confidence in attaining my goal.*		Believing I could succeed Believing I could figure it out Doubting my ability Having low expectations of myself Feeling like I am bad at this
Goal & Time Management *Setting goals and managing & prioritizing time.*		Finding time to work Breaking things down into smaller goals Prioritizing time & tasks Organizing my time Running out of time Setting goals for studying Missing deadline/s
Choosing or Using Strategies *Knowing which strategies to use.*		Didn't know how to approach it Didn't know a strategy to use Chose the wrong strategy Didn't know how to fix my strategy
Learning & Remembering *Being able to remain focused on learning and remembering key information.*		Couldn't remember things Kept losing focus Couldn't figure out what was important Couldn't apply what I was learning Couldn't explain concepts/ideas
Life & Self-Management *Life events such as sleep, relationships or health.*		Distracted by other things in life Sick or tired Not eating well Family and relationship issues
Optimizing conditions/setting for study *Finding a suitable workspace.*		Finding a good workspace Too many distractions Distracted by friends/roommates Not conducive for thinking/learning
Language & Communication *Being able to communicate ideas.*		Didn't understand words Couldn't express ideas Stuck on terminology Didn't know how to ask a question Couldn't think about it in English
Adjusting to a New Culture *Adjusting to new learning situations and contexts; making new friends*		Feeling lonely Missing friends/family Unsure of what is expected of me Unsure of what is appropriate Overwhelmed by how different things are
Emotions *The role emotions played in your work this week.*		Anxiety, boredom, excitement, worry, anger, frustration, sadness, hopelessness, guilt, shame, disappointment, etc.
Mental Health & Well-Being *How I cope with relationships, work, and stress to be productive.*		Feeling stressed or overwhelmed most days, not enjoying being at university, struggling with social relationships, not feeling in control of my life.

Challenge rating:
0-Not applicable this week
1
2
3
4
5-Negatively affected me this week


Challenge: Motivation, procrastination, confidence, goal & time management, choosing or using strategies, learning and remembering, life & self management, getting to class, optimizing location/conditions for study, language & communication, adjusting to a new culture, feelings/emotions, mental health & well-being, something else
Strategy: did nothing, asked for help, worked with a friend, avoided the task, adjusted my understanding of the task, adjusted my original goal, set a different goal, adjusted my approach/strategy, switched to a different approach/strategy, changed the way I was feeling about it, changed my effort, persisted, re-evaluated my progress toward my goal, reprioritized my goal, did something else
Question 11
Not yet answered
Not graded
The main challenge I encountered in attaining the goal I set for myself last week was
. Describe the challenge:
So I
and it was
successful.
Maybe next time, I should
Strategy effectiveness: not at all, minimally, moderately, completely
Question 12
Not yet answered
Not graded
During this study session, I mainly felt
. This
feeling
made it
to achieve my session goal.
When I felt this way, I
and I
am
satisfied with the result.
Emotion regulation strategy effectiveness: very easy, easy, hard, very hard
Emotion regulation strategy intensity: very weak, weak, moderate, strong, very strong
Question 13
Not yet answered
Not graded
What is the most important thing I have learned about my learning or motivation this week?
Emotion regulation strategy satisfaction: not at all, minimally, moderately, completely
Emotion: relieved, hopeful, anxious, happy, proud, bored, frustrated, interested, excited, disappointed, hopeless, afraid/worried, tired, stressed, focused, something else
Emotion regulation strategy: took a break, focused on getting the task done, changed my approach to studying, tried a new strategy altogether, thought about the consequences of finishing or not finishing the task, promised myself a reward for finishing the task, talked to someone, worked with someone, avoided doing the task, changed the way I was feeling about myself or my studying, changed my feeling directly (e.g., took deep breaths), changed my studying location or environment, did nothing, did something else

Appendix B: Multi-level model equations for all models in this study

Variable	Level	Unconditional model equation	Time conditioned model	Coupled-change model equation with PWB as the outcome variable
Psychological well-being (PWB; outcome variable)	Level 1	$PWB = \beta_{0i} + r_{it}$		-
	Level 2	$\beta_{0i} = \gamma_{00} + u_{0i}$		-
Academic engagement (AcaEng)	Level 1	$AcaEng_{it} = \beta_{0i} + r_{it}$		$PWB_{it} = \beta_{0i} + \beta_{1i}(TIME_{it}) + \beta_{2i}(AcaEng_{it} - PMAcaEng_i) + r_{it}$
	Level 2	$\beta_{0i} = \gamma_{00} + u_{0i}$	Level 1: $PWB_{ti} = \beta_{0i} + \beta_{1i}(TIME_{it}) + r_{it}$ Level 2: $\beta_{0i} = \gamma_{00} + u_{0i}$ $\beta_{1i} = \gamma_{10} + u_{1i}$	$\beta_{0i} = \gamma_{00} + \gamma_{01}(PMAcaEng) + u_{0i}$ $\beta_{1i} = \gamma_{10} + u_{1i}$ $\beta_{2i} = \gamma_{20}$
Goal attainment (GoalAtt)	Level 1	$GoalAtt_{it} = \beta_{0i} + r_{it}$		$PWB_{it} = \beta_{0i} + \beta_{1i}(TIME_{it}) + \beta_{2i}(GoalAtt_{it} - PMGoalAtt_i) + r_{it}$
	Level 2	$\beta_{0i} = \gamma_{00} + u_{0i}$		$\beta_{0i} = \gamma_{00} + \gamma_{01}(PMGoalAtt) + u_{0i}$ $\beta_{1i} = \gamma_{10} + u_{1i}$ $\beta_{2i} = \gamma_{20}$
Goal satisfaction (GoalSat)	Level 1	$GoalSat_{it} = \beta_{0i} + r_{it}$		$PWB_{it} = \beta_{0i} + \beta_{1i}(TIME_{it}) + \beta_{2i}(GoalSat_{it} - PMGoalSat_i) + r_{it}$
	Level 2	$\beta_{0i} = \gamma_{00} + u_{0i}$		$\beta_{0i} = \gamma_{00} + \gamma_{01}(PMGoalSat) + u_{0i}$ $\beta_{1i} = \gamma_{10} + u_{1i}$ $\beta_{2i} = \gamma_{20}$

	Level 1	$MHWB_{it} = \beta_{0i} + r_{it}$	$PWB_{it} = \beta_{0i} + \beta_{1i}\,(TIME_{it}) + \beta_{2i}\,(MHWB_{it} - PMMHWB_i) + r_{it}$
Rating of mental health and well-being challenge (MHWB)	Level 2	$\beta_{0i} = \gamma_{00} + u_{0i}$	$\beta_{0i} = \gamma_{00} + \gamma_{01}(PMMHWB) + u_{0i}$ $\beta_{1i} = \gamma_{10} + u_{1i}$ $\beta_{2i} = \gamma_{20}$

Note: PM = person mean before the variable in the level 2 coupled-change model.Appendix C3: Paper 3

Appendix C3: Paper 3

Davis, S. K., Rostampour, R., Hadwin, A. F., & Rush, J. (2020). The role of mental health in adaptive regulation of learning and student success. *Manuscript in preparation.*

The role of mental health in adaptive regulation of learning at university

Sarah K. Davis, Ramin Rostampour, Allyson F. Hadwin, and Jonathan Rush

University of Victoria

Author Note

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Abstract

The purpose of this case study was to examine mental health and adaptive regulation exhibited by two contrasting groups of students (i.e., the high mental health group and the low mental health group) in a university learning-to-learn course. The purpose of this case study was to examine if students' mental health affects their engagement in adaptive regulation and metacognitive evaluations of the role their mental health plays in their learning. Participants were 229 students enrolled in an undergraduate learning-to-learn course where students learned about SRL theory and how to apply it to their own learning. Extreme case sampling was used to identify students with high mental health (MH) (n = 27) versus low MH (n = 22) based on weekly measures of mental health (Keyes, 2009). Groups were compared on (a) self-reported challenges, (b) strategies adopted to tackle challenges, and (c) goal attainment. Findings indicated that students in the high MH group reported meeting a higher percentage of their study goals. A within-person analysis revealed students in the low MH group tried maladaptive paths more often than students in the high MH group. Qualitative analysis of an open-ended writing assignment revealed students in the low MH group described socioemotional, career, and academic challenges causing lower mental health. Students in the high MH group described social relationships as beneficial to their mental health. Implications for theory, research, and practice are discussed.

Keywords: case study, mental health, self-regulated learning, university

The role of mental health in adaptive regulation of learning at university

From 2000 to 2014, the number of students enrolled in higher education doubled from 100 million to 207 million (UNESCO, 2017). Obtaining a tertiary degree has wide-ranging benefits for both individuals and society. Individuals with a tertiary degree will earn 56% more during their lifetime on average than individuals who only completed secondary education (OECD, 2019), and have better health, job prospects, and higher social status (Murray, 2009). These individual benefits also affect the larger society by requiring less national spending on health and welfare and building a larger tax base. However, these benefits only affect those who successfully attain a university degree. Among OECD countries, the average persistence rate of students who were still enrolled in university after one year ranges from 76% to 92% (OECD, 2019). In addition, one out of four enrolled students had not graduated within two years of the end of the program, and four out of five of these students did complete graduation requirements. One of the main goals of student retention is to prevent students from leaving university, whereas student success focuses on student experiences and engagement at the institution (Kuh et al., 2007). A research shift from retention to student success moves the focus from institution to the individual student and has been instrumental in determining why students are successful or not in attaining a degree.

From Student Retention to Student Success

Student success research (a) focuses on the success fostering experiences and/or characteristics of students at university (Kuh et al., 2007), and (b) operationalizes success as academic performance and/or intent to stay enrolled in university. Three domains have been highlighted as crucial to student success: socioemotional adjustment, critical thinking, and

academic achievement (van der Zanden et al., 2018). Socioemotional adjustment recognizes attending university is a significant transition from secondary education and students must cope with academic, social, and emotional challenges at university. Critical thinking is a crucial skill for students to have upon graduating and this includes both the ability to analyze arguments and make judgments, but also to engage and use effort. Academic achievement can include grades in courses or semesters, consistent with the benchmarks universities use to move students along in their progression toward a degree. Importantly, these three domains are interrelated and require a multidimensional focus to understand student success.

At the root of all success in university is how students navigate their academic learning, ranging from selecting a program of study and selecting courses, to managing assignments, studying for exams, and synthesizing course material to create new types of knowledge. Students may be successful in some domains of life at university and struggle with other domains. Thus, using a finer-grained definition of student success as successfully attaining self-set goals, emphasizes that success involves processes and experiences necessary for success during learning. When students are successful in regulating their learning at university, they may engage in a range of processes or strategies to complete their work. They may do this by consciously or subconsciously understanding what they have to do (e.g., write a paper, study for an exam) setting goals (e.g., when they will get the task done), selecting strategies (e.g., interleaving practice, Cornell note-taking, practice problems), and checking in to see if they need to make changes or additions.

When students fail to attain their proximal goals during a semester, their overall academic success is a jeopardy. Understanding and intervening with the regulatory processes

that lead to these failed goal outcomes is essential for delivering appropriate and timely interventions with potential to change long term success trajectories.

Self-Regulated Learning

Self-regulated learning (SRL) is when students strategically direct and control their behaviour, cognition, motivation, and emotion to attain self-set goals (Pintrich, 2004; Schunk & Greene, 2018; Winne & Hadwin, 1998; Zimmerman, 1989, 2000). A goal is a cognitive representation of a desired end state, and critical for effective SRL (Pekrun, 2000). Importantly, SRL is not about individual learning but autonomous learning; SRL is grounded in social cognitive theory that recognizes humans are social beings who learn in social context. Metacognitive awareness and monitoring are activated as students set goals, enact their plans, and reflect on their progress. Engaging in these processes and strategies is especially useful at university, where students must navigate new contexts and challenges (Hadwin & Winne, 2012). This is because SRL recognizes students may need to regulate all or some of these processes when experiencing challenges during learning.

When students learn or study, they may be unaware of some or all the aspects involved in regulating their learning. Automaticity in SRL means students may be subconsciously regulating their behaviour, cognition, motivation, and/or emotions during learning and only need to consciously engage in metacognition when they experience a learning challenge (see Hadwin et al., 2011, 2018). Researching SRL when challenges are faced is ideal; when students experience challenges, previously subconscious processes need to be consciously activated by students to actively, engage to overcome challenges and be successful. For example, while studying for a biology exam, a student may have no problems understanding the task, setting goals, using strategies, and monitoring their progress. But

when that same student experiences a novel challenge such as attempting to write a psychology paper in APA style for the first time, they may experience a variety of challenges they do not know how to overcome. For example, they may struggle with their motivation in order to get started, feel frustrated and want to give up, and/or not know what writing strategies are effective. Any of these challenges can be addressed by engaging with SRL processes or strategies.

Rather than viewing SRL as an outcome or disposition, contemporary models view it as cycles of proactive and strategic actions which ultimately lead to attainment of self-set goals through driving successful adaptation in the face of challenges (Winne, 2018). Winne and Hadwin's (1998) 4 phase model describes SRL as a cyclical, recursive process highlighting task perceptions, goal-setting and planning, task enactment, and large-scale adaptation. Metacognitive monitoring and evaluating takes place during every stage as students check their progress toward their academic goals and make revisions at any or all the necessary phases. Further, the COPES architecture guides each phase where the micro-level interactions between *c*onditions, *o*perations, *p*roducts, *e*valuations, and *s*tandards occur within the macro-level phases of SRL (Winne, 1997). Davis et al. (2019) determined mental health is an internal condition affecting learning. Other self-factors determined to be conditions affecting learning are cognition, motivation, emotions, and beliefs (Winne, 2018). A large body of research has examined how the self-factors of cognition (e.g., Winne, 2014), motivation (e.g., Wolters & Hoops, 2015), emotions (e.g., Webster & Hadwin, 2015), beliefs (e.g., Bjork et al., 2013) affect SRL. However, one under examined area of research is the role of mental health as a condition in students' engagement with SRL processes and strategies at university.

Mental Health

Mental health is a state of well-being where individuals cope with daily life stressors, engage, and maintain meaningful relationships, and contribute to society (WHO, 2016). Distinct from mental illness, mental health comprises psychological, social, and emotional well-being (Keyes 2002, 2005). The dual-factor continua model of mental health situates mental health and mental illness as separate, yet related factors, defining mental health as more than just the absence of mental illness, but ranging from languishing to moderate to flourishing mental health (see Figure 1). Peter et al. (2011) found 24% of university students have flourishing mental health, 67% have moderate mental health, and 9% have languishing mental health (Peter et al., 2011).

Individuals with flourishing mental health tend to miss few days of work/school, experience more positive than negative emotions, and function well both psychologically and socially (Keyes, 2003). Individuals with languishing mental health tend to experience few positive emotions, do not function well psychologically and/or socially, and have not be diagnosed with depression in the past year. University students are particularly at risk for languishing mental health due to social isolation, new environments and challenges, and navigating unknown contexts. This may put university students at higher risk for mental illness; adults with languishing mental health are six times more likely to develop a mental illness after 10 years (Keyes et al., 2010). Therefore, fostering mental health is not only key in preventing mental illness, but also may be beneficial for promoting student success at university.

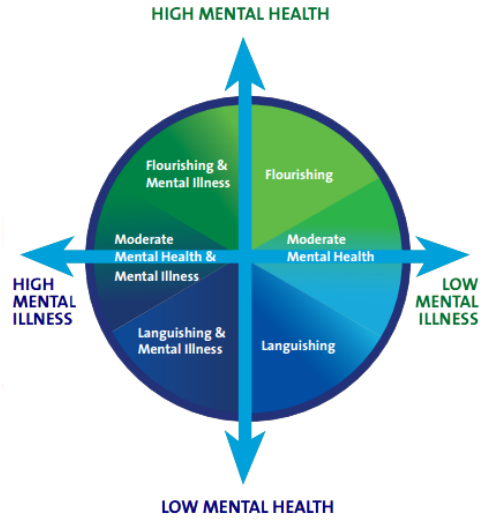

Figure 1. Keyes' dual-continua model of mental health. Figure from "Promoting and protecting positive mental health: Early, and often throughout the lifespan," by C. L. M. Keyes in C. L. M. Keyes (Ed.), *Mental well-being: International contributions to the study of positive mental health* (p. 17), 2013, Netherlands: Springer. Copyright 2013 by C. L. M. Keyes. Reprinted with permission.

From a student retention perspective, mental health concerns are a common reason for leaving university (Prince, 2015; Svanum & Zody, 2001; Yorke & Longden, 2008). Universities have developed a wide range of on-campus mental health promotion programs with most operating as supplemental to academic work rather than integrated within academic contexts. In general, students do not seek help for their mental health (ACHA, 2016, 2018; Leitch, 2007), although recent studies show more students are now accessing campus resources, such as counselling and health services (see Prince, 2015; Rückert, 2015). These resources are becoming overwhelmed with requests, resulting in long wait times as services cannot keep up with student demands for services.

Furthermore, at a finer-grained student success perspective, little research examines how mental health is implicated in students' attainment of self-set goals, which are paramount to effective learning. Previous research on mental health and SRL, while limited,

indicates students with higher psychological well-being attain more self-set goals and may engage in more adaptive regulation (Davis & Hadwin, 2019). Additionally, psychological well-being and academic engagement are associated over time (Davis et al., 2019). Students with higher mental health report more adaptive academic functioning and have higher self-reported grades (Howell, 2009). Continuing to examine the role of mental health during SRL recognizes students can potentially optimize their mental health by leveraging processes and strategies during learning, Rethinking mental health promotion as embedded within the classroom or any time learning takes place at university, therefore, could focus on how students strategically regulate their learning and mental health to be successful.

Adaptive Regulation and Mental Health

Students who self-regulate their learning engage in a type of "learning homeostasis." Homeostasis usually refers to how humans' physiological systems maintain balance among and across the various systems (e.g., lung and heart function, nervous system, temperature). During learning, students need to continually monitor and evaluate their progress toward goals and adjust as needed. This includes regulating behavior, cognition, motivation, affect, and/or mental health. Based on the COPES framework outlined in the Winne and Hadwin (1998) 4 phase SRL model, self-regulation involves recognizing discrepancies occurring during the process of attaining goals and subsequently taking action to resolve that discrepancy (Winne & Hadwin, 2008). However, not all students recognize when a discrepancy is occurring or take strategic action to resolve the problem. Thus, maintaining learning homeostasis may be especially salient for student success.

Strategic regulation describes the process when students detect a mismatch between their goals and their goal progress and choose from a set of options to persist, try a new

strategy, adjust the current strategy, update planning, or cease engagement with the task (Hadwin et al., 2019). Adaptive regulation is when students recognize there is a barrier to their goal progress and attempt to remedy the situation by employing SRL processes and/or strategies. Maladaptive regulation describes the process when students fail to recognize a challenge is interfering with progress or recognize the challenge but fail to choose effective strategies. Mental health may affect adaptive regulation of learning (see Davis & Hadwin, 2019), indicating that the interplay between mental health and SRL may vary depending on students' mental health (i.e., languishing to flourishing) during a semester.

Students engaging in adaptive or maladaptive regulation address academic challenges when they arise over the course of their studying. This involves regulating learning by choosing, using, and adapting a strategy. From a self-regulated learning perspective, learners should choose and test strategies for challenges rather than using the same one for every challenge they run into (e.g., Hadwin et al., 2001). However, capturing this information as it is occurring is challenging. Measuring SRL has moved from broad, aptitude-based measures at one time point to event-based measures capturing SRL (Winne & Perry, 2000), either when it is occurring (e.g., trace data, physiological indicators) or shortly thereafter (e.g., self-report, think-alouds). Most research on SRL and mental health to date has used broad, aptitude-based measures (e.g., Howell, 2009) and only considered between-person comparisons, rather than within-person, or considering regulatory processes at the event level.

Mental health is a subjective experience, with fluctuations over time considered normal (Keyes, 2002, 2003). Therefore, capturing the interplay between mental health and adaptive regulation with self-report has the most potential to not only inform the

understanding of mental health and SRL, but also to provide students with data they can use as feedback about their learning. Every learning instance is an opportunity for students to collect data about themselves and their learning (Winne, 2005). However, previous studies on mental health and SRL do not indicate if students had access to information about their mental health (e.g., Grunschel et al., 2016). Therefore, including students' interpretations of their mental health data collected during learning could also provide important insights for students and researchers about their own metacognitive awareness.

Although some previous research has examined mental health and SRL, limited research examines (a) mental health and adaptive regulation concurrently over time, or (b) students' interpretations of the role of their mental health during SRL. Davis and Hadwin (2019) identified mental health as an internal condition affecting learning, however, it remains unclear the role mental health plays in adaptive regulation.

Purpose and Research Questions

The purpose of this case study was to examine mental health and adaptive regulation exhibited by two contrasting groups of students (i.e., the high mental health group and the low mental health group) in a university learning-to-learn course. Three research questions were compared for students reporting high versus low mental health:

1. What challenges do students in each group report strategically addressing during study sessions?
2. What adaptive and maladaptive regulatory paths are engaged by students during study sessions?
3. How do students in each group interpret their mental health collected during weekly study sessions over the course of a semester?

Methods

A case study approach was used to advance the understanding of the under examined interplay between mental health and adaptive regulation. In particular, we used a multiple case embedded design (Yin, 2014).

Course Context

The broader context of this case study was the fall 2018 and spring 2019 semester of an academic, credited undergraduate course about SRL and strategies for academic success. Each week, students attended one 80-minute lecture introducing the science of learning and motivation from a self-regulatory perspective, and one 80-minute seminar where knowledge was actively applied to studying. Topics in the course included procrastination, motivation, emotion, time management, test anxiety, collaboration, and mental health. This elective educational psychology course enrolls students from across faculties and disciplines. Students represent a broad array of academic proficiency levels. Participants in this study had an average semester GPA for the 234 consenting students enrolled in these two semesters of the course was 4.17(*SD* = 2.17) on a 9.0 GPA scale, which is equivalent to a B- average or 70-72%. In the course itself, the average course grade was 70.17(*SD* = 15.38).

Procedures

The institution's Human Research Ethics Board approved all procedures in this study. All students in this study consented to participate through implied consent by being enrolled in the course and not electing to withdraw from the research study. No incentive was provided to students for participating in the research and all data collected was a part of regular graded and non-graded course activities.

Variables and Measures

Data collected in this study came from institutional data about students' academic performance, and two course activities that prompted students to apply course concepts to their own studying: ten online SRL diary tools (10% of course grade) and the SRL Report (15% of course grade).

Academic Performance

Semester GPA. Students' semester GPA was obtained by institutional data in the subsequent semester. The university uses a nine-point GPA scale, where 0 = E (0-49%), 1 = D, (50-59%), 2 = C (60-64%), 3 = C+ (65-69%), 4 = B- (70-72%), 5 = B (73-76%), 6 = B+ (77-79%), 7 = A- (80-84%), 8 = A (85-89%), and 9 = A+ (90-100%).

Overall course grade. Students' course grade reflects overall performance in the learning-to-learn course and comprised coursework and a grade on a final exam taken at the end of the semester. Grades could range from 0% to 100%.

Online SRL Diary Tool

The SRL diary tool (Hadwin et al., 2018) promotes metacognitive planning, monitoring and awareness for one study session. The four sources of data were embedded in the SRL diary tool. Students completed the diary tool in two parts. In the first part, students reflected on their previous week by responding to questions about their mental health, before setting a goal for a 1-2 hour study session that week. In part two, students reported their goal attainment, main challenge encountered, strategy selected, and reflect on other aspects of their study session. The following four sources of data were embedded in the SRL diary tool (see Appendix A for the online SRL diary tool questions).

Mental Health. The 14-item Mental Health Continuum-Short Form (MHC-SF; Keyes, 2009) was incorporated into the weekly study diary plan. Items assessed three factors of mental health (i.e., psychological, emotional, and social well-being on a 5-point Likert scale from 1 (never) to 5 (every day). The average weekly range of Cronbach's α was .89-.95 for this study, with values above .70 or .80 indicating good reliability (Kline, 1999).

Challenges. Each week, **s**tudents selected one main challenge experienced during the study session by selecting from a dropdown list of eleven possible challenges (see Hadwin et al., 2019). Challenges included: motivation, goals and planning, cognition, mental health, study environment, emotion, strategy enactment, vocabulary, language and culture, and other.

Strategies. Students selected the main strategy they used to address the main challenge by choosing from a dropdown list in the diary tool of nine strategies: passive, goal management, persist, help-seeking, emotion regulation, change effort, task understanding, strategy adjustment, and other.

Goal attainment. Each week, after completing the 1-2 hour study session, students made a judgment about their goal attainment by choosing from two possible options (a) did attain, or (b) did not attain.

SRL Report

The SRL Report was the major writing assignment for the course. As students often need guidance in collecting and interpreting their own learning data (see Winne, 2005), the aim of the SRL Report was to have students collect and summarize data from their weekly SRL study diaries about four areas of their learning: academic engagement, mental health,

goal quality, and challenges and strategies used in an Excel spreadsheet, worth 3% of the assignment mark. For the other 12% of the assignment mark, students wrote a 1000-word (maximum) essay based on their interpretations of this data. Four prompts guided the structure of the essay for students. Responses to the first two prompts were used in this study: (a) summarize your strengths and weaknesses for engagement, mental health, goals, and challenges, (b) identify and justify one target for change.

Case Sampling Strategy and Case Descriptions

A case study approach (Yin, 2014) was chosen as the research method in order to examine the interplay between mental health and SRL at university in a real-life context. Butler (2011) outlines three reasons why case studies are ideal methodologies for studying SRL in depth. First, case studies (a) are well-suited to study the relationship between constructs involved in SRL, (b) can examine SRL as a dynamic and recursive event/activity, and (c) can identify the interplay between individual and social processes as they unfold during authentic learning activities. Butler and Cartier (2018) recommend triangulating across data sources to study SRL. This study examined students' interpretations, engagement in SRL, and experiences by triangulating across four data sources: institutional data, course data, student journals (i.e., the online SRL diary tool) and cued reflections (i.e., the SRL Report). A multiple-case design with multiple embedded units of analysis was used (see Yin, 2014). Table 1 overviews the research questions and their units of analyses.

Table 1

Details of the multiple-case design and the data sources for each research question

	Case Sampling Description	RQ1	RQ2	RQ3
Type of comparison	Extreme case sampling	Cross-case comparison at the event level: Descriptives and risk ratios	Cross-case comparison at the within-person level: Adaptive and maladaptive paths	Cross-case comparison at the between-person level: Descriptives and causation coding
Data source	Weekly online SRL diary tool	Weekly online SRL diary tool	Weekly online SRL diary tool	SRL Report
Embedded unit(s) of analysis	Weekly mental health score	Main challenge, main strategy, goal attainment	Main challenge, main strategy, goal attainment	Strengths and weaknesses about mental health, target for change

Extreme case sampling (Miles et al., 2013) was used to identify two contrasting groups of students based on their overall mental health scores. One group of students consistently had high mental health (i.e., the high MH group) during a semester of a learning-to-learn course, and one group of students consistently had low mental health (i.e., the low MH group). Due to the repeated nature of our measurement over 10 weeks of a semester using the online SRL diary tool containing the mental health measure, we employed a time-sensitive method for identifying contrasting groups that accounted for fluctuations in mental health over time. To form the groups, the normality of all students' mental health weekly distributions was verified and means and standard deviations for each week were computed. Students who scored 1 SD above or below the weekly means were identified as members of the high MH or low MH group respectively by week. Finally, cases were narrowed down to

students who were identified as member of the high MH or the low MH group at least half of the weeks (5 out of 10). Participants who completed fewer than 50% of the weekly online diaries were excluded from the study.

Participants in the two groups were 49 students selected from a larger sample of 229 consenting students enrolled in two semesters of an undergraduate elective learning-to-learn course. Students in the high MH group (n = 27) were 33% female, and 78% of the group were first year students while this proportion was 59% female and 68% first year students for the low MH group (see Table 2). Examining confidence intervals for the academic performance data shows no differences between the two groups for the final course, semester, or SRL report grades.

Table 2

Demographic and academic performance descriptives for the two groups

					Final course grade		Semester grade		SRL Report grade	
Group	*n*	Male	Female	First year	Mean(SD)	95% CI	Mean(SD)	95% CI	Mean(SD)	95% CI
Low MH	22	9	13	15	74.60(10.09)	[70.384, 78.816]	4.26(2.03)	[3.4117, 5.1083]	10.98(2.72)	[9.8434, 12.1166]
High MH	27	18	9	21	74.33(9.78)	[70.641, 78.019]	4.29(1.66)	[3.6639, 4.9161]	12.26(2.25)	[11.4113, 13.1087]

Analysis and Findings

RQ1: What challenges do students in each group report strategically addressing during study sessions?

A higher percentage of students in the low MH group reported failing to meet their self-set study goals (22.6%) compared to students in the high MH group (13%). Table 3 summarizes the between group comparisons for challenges and goal attainment reported in frequencies and failure rates at the event level. Frequencies are the number of times each challenge was reported followed by the percentage of the total events each group reported that challenge. For example, 73 motivation challenges were reported by the low MH group, which comprised 36.7% of the overall challenges reported by the low MH group. Failure rates are the number of times encountering each challenge led to students failing their self-set goals regardless of the strategies they used. For example, for the 81 motivation challenges reported by the high MH group, regardless of the strategy being used, 12 of those events led to not attaining the goal.

Table 3

Frequency and failure rate of challenges across the two groups at the event level

	High MH Group		Low MH Group		Both Groups	
Challenge	Frequency (%)	Failure rate (%)	Frequency (%)	Failure rate (%)	Frequency (%)	Failure rate (%)
Motivation	73 (36.7%)	19 (26%)	81(37.5%)	12(14.8%)	153(36.8%)	31(42.4%)
Goal & Planning	41 (20.6%)	13 (31.7%)	54 (25%)	10 18.5%)	95(22.8%)	23(31.5%)
Mental health	16 (8%)	4 (25%)	16 (7.4%)	0 (0%)	36(8.6%)	4(5.4%)
Cognition	20 (10%)	3 (15%)	15 (7%)	0 (0%)	35(8.3%)	3(4.1%)
Study Environment	13 (6.5%)	4 (30.8%)	16 (7.4%)	1 (6.3%)	29(7%)	5(6.8%)
Other	12 (6%)	1 (8.4%)	12 (5.6%)	4 (33.4%)	24(5.7%)	5(6.8%)
Emotion	11 (5.5%)	1 (9%)	10 (4.6%)	1 (10%)	21(5%)	2(2.7%)
Strategy Enactment	6 (3%)	0 (0%)	10 (4.6%)	0 (0%)	16(3.7%)	0(0%)
Vocabulary	5 (2.5%)	0 (0%)	2 (1%)	0 (0%)	7(1.6%)	0(0%)
Language and culture	2 (1%)	0 (0%)	0 (0%)	0 (0%)	2(0.5%)	0(0%)
Overall (Met goal)	154 (77.4%)	-	188 (87%)	-	342(82.4%)	-
Overall (Did not meet goal)	45 (22.6%)	45(100%)	28 (13%)	28(100%)	73(17.6%)	73(100%)
Total	199(100%)	-	216(100%)	-	415(100%)	-

Motivation and goal & planning challenges were (a) most frequently reported by both groups, and (b) had more instances reported that led to not attaining the goal. These two challenges together accounted for 63% of challenges reported by students in the low MH group and 57% of the challenges reported by students in the high MH groups. When these two challenges were faced, 33% of the low MH group students and 57% of the high MH group students reported not attaining their goal. Both groups reported the same amount of mental health challenges; however, the high MH group was always successful in attaining their goal when they reported a mental health challenge, whereas the low MH group failed to attain their goal 25% of the time when they reported a mental health challenge.

To compare how both groups strategically addressed these three challenges (i.e., motivation, goal & planning, mental health), the strategies used by each group were plotted in terms of their frequency and failure rates (e.g., the percentage that using a strategy has led to instances of goal failure). Combining these two dimensions (i.e., the prevalence of a strategy and the percentage of its unsuccessful use) reveals the risk of running into a challenge or using a strategy in terms of goal failure. For example, when a motivation challenge was reported, events where students in the low MH group reported using passive strategies (e.g., avoid the task or do nothing; 21% of the time) which resulted in failing to attain goals 60% of the time.

Figures 2-4 show the frequency and risk of strategies at the event level for high and low MH groups. Both groups overused ineffective strategies and underused effective strategies. The risk of a strategy was operationalized in terms of the percentage of times (i.e., events) students in the respective groups reported running into challenges (see Figures 2-4, horizontal axis) as well as the percentage of times students encountered challenges and were not able to meet their goals (Figures 2-4, vertical axis). These risk graphs depict variables of interest at the event level. Strategies with higher rates of failure were more frequently used across both groups.

Figure 2 displays how students in both groups tended to adopt passive and persisting strategies in response to motivation challenges. When students in the low MH group reported motivation challenges, they reported using passive strategies 60% of the time, and failed to attain their goal 21% of the time, compared to high MH group students who reported using passive strategies 17% of the time and failed goal attainment 43% of the time. Students in the

low MH group reported persisting 19% of the time and failed to attain their goal 21% of the time, compared to high MH group students who reported persisting 22% of the time and failed goal attainment 11% of the time.

In Figure 3, students in both groups also reported using passive strategies less than with motivation challenges, but the failure rates were higher for these strategies. When students in the low MH group reported goal and planning challenges, they reported using passive strategies 7% of the time, and failed to attain their goal 67% of the time, compared to high MH group students who reported using passive strategies 9% of the time and failed goal attainment 60% of the time. Both groups also reported using goal management as a strategy for goal and planning challenges with similar rates, but the low MH group had higher rates of goal attainment compared to the low MH group. Students in the low MH group reported using goal management strategies 39% of the time and failed to attain their goal 35% of the time, compared to high MH group students who reported using goal management strategies 35% of the time and failed goal attainment 21% of the time.

Finally, Figure 3 displays that students in the low MH group underused strategies such as task understanding, changing effort, and emotion regulation when they reported a mental health challenge, compared to the high MH group who used a variety of strategies leading to goal attainment. For the low MH group, students reported using passive strategies to address a mental health challenge 25% of the time, even though 75% of the time students reported not attaining their goals. Other strategies, such as persist, emotion regulation, and strategy adjustment were used infrequently even though they always resulted in goal attainment. Task understanding, changing effort, goal management, and help-seeking were

not used at all. Whereas the following strategies reported by students in the high MH group always resulted in goal attainment: help-seeking (31% of the time this strategy was selected), persist (25%), other (19%), and emotion regulation (13%).

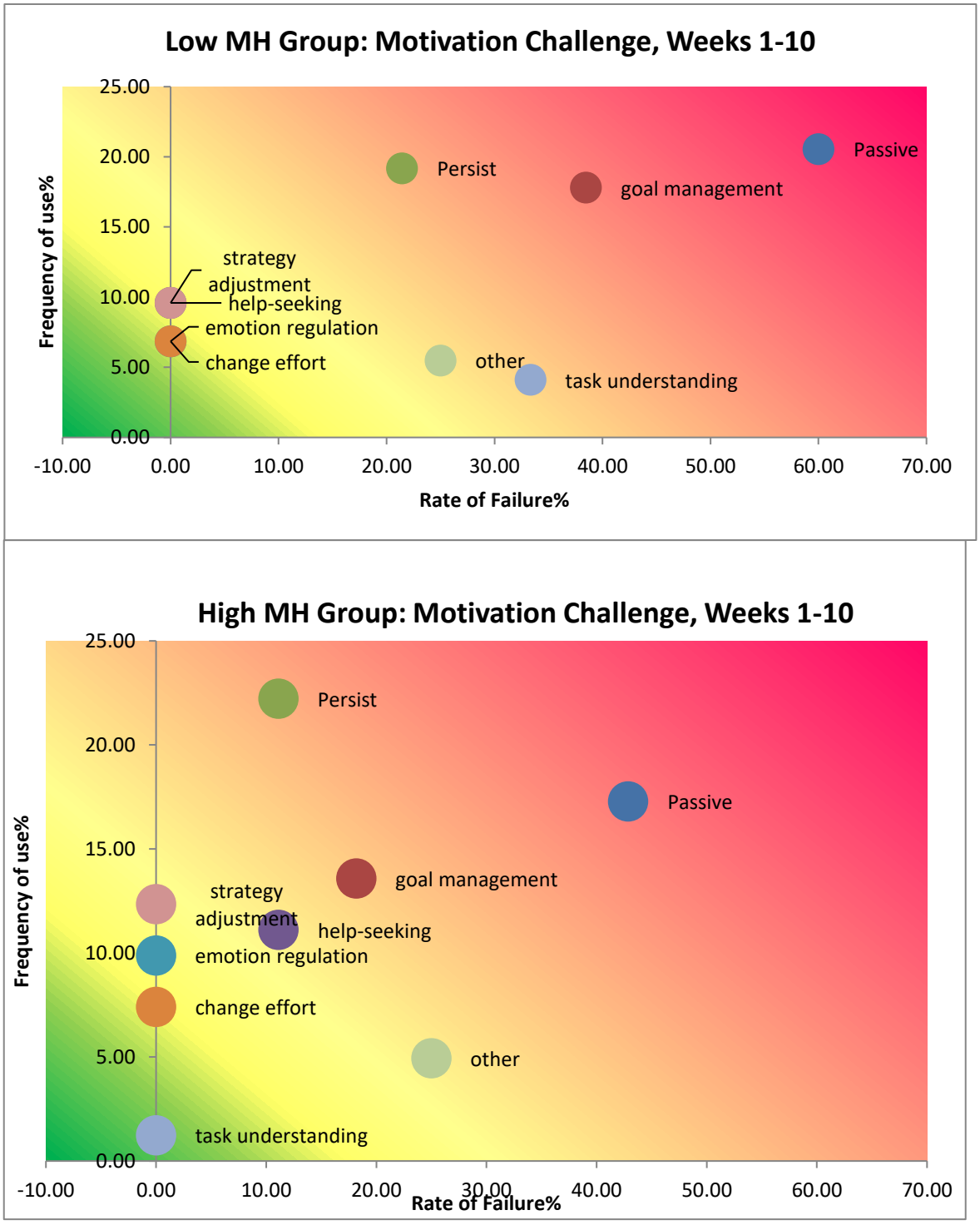

Figure 2. Risk graphs for the motivation challenge for both groups. *Note: The horizontal axis represents the percentage of times when students reported using strategies and the vertical axis represents the percentage of times when students used strategies and were not able to meet their goals. For example, students in the high group who encountered motivation challenge, used passive strategy about 17% of times and about 43% of their use of this strategy led to goal failure. The green, yellow, and red colors in the background respectively indicate low, medium, and high-risk areas for not attaining the goal.*

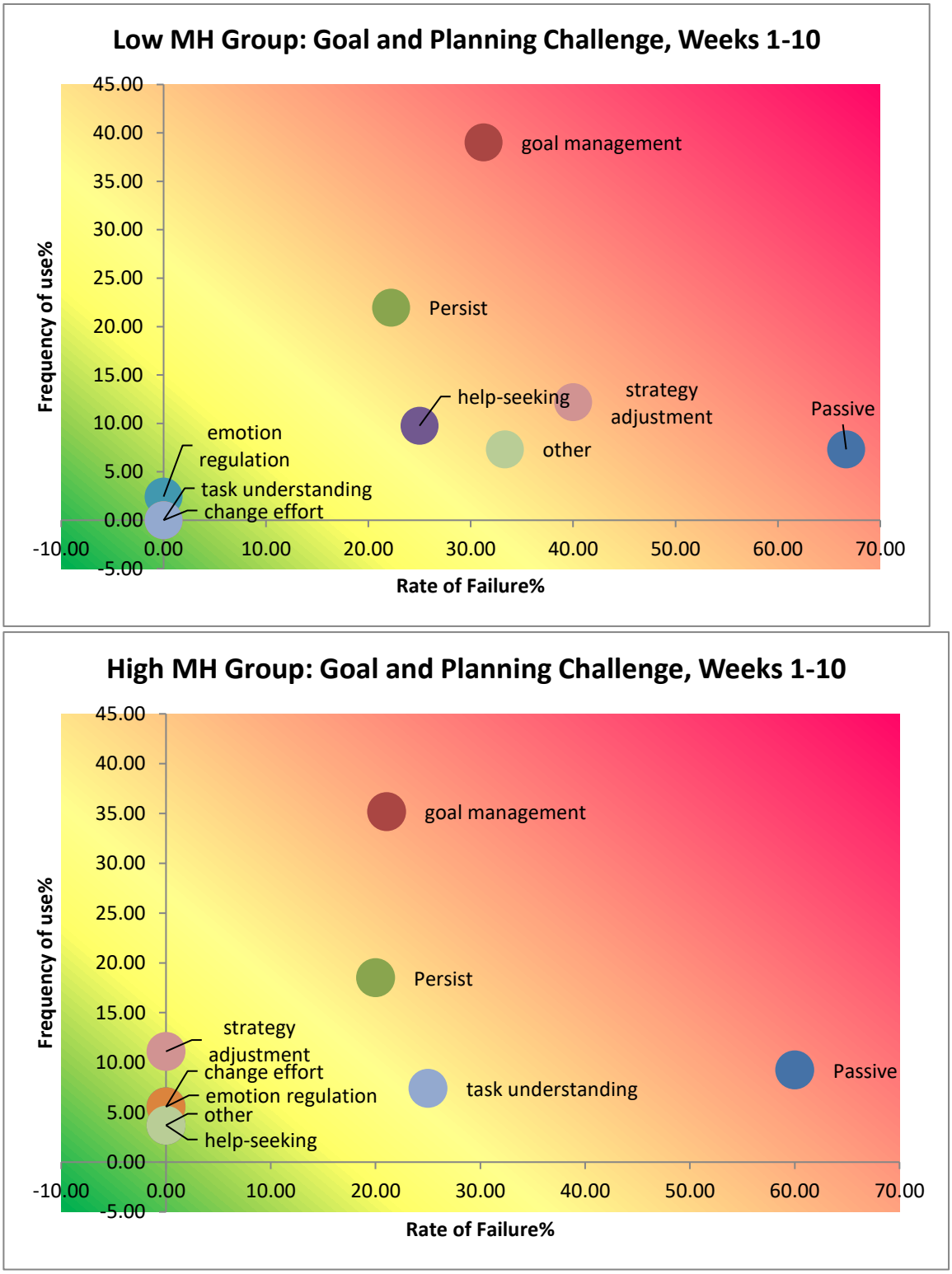

Figure 3. Risk graphs for the goal and planning challenge for both groups.

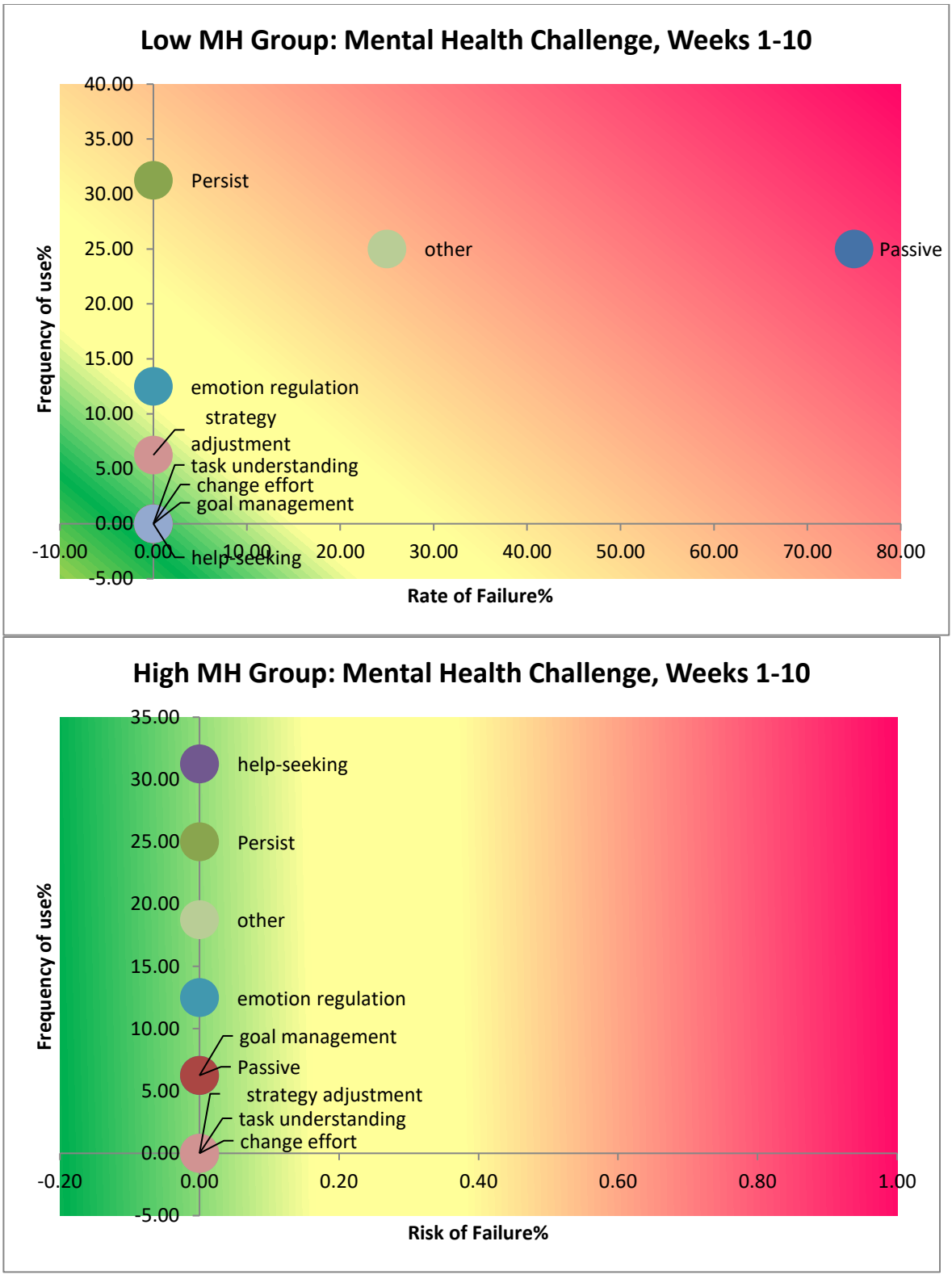

Figure 4. Risk graphs for the mental health challenge for both groups.

RQ2: Are there differences between groups in how students engage in maladaptive regulatory paths during study sessions?

The analyses for RQ1 were at the event level for both groups, whereas the analysis for RQ2 was at the within-person level for both groups. We conducted a within-person analysis to test if there is any difference, between two groups, in terms of tendency to retry a maladaptive path. A maladaptive path is a combination of a challenge a person encountered and a strategy they adopted that has led to goal failure (ChallengeX➞StrategyY➞Did Not meet one's goal). We counted the number of times each student retried such maladaptive paths over 10 weeks of the study.

As shown in Table 5, about 7 percent of members of the high MH group retried a maladaptive path at least once more, on average. In contrast, about 23 percent of members of the low MH group retried a maladaptive path, an average of 1.4 times more. Such maladaptive paths were mostly observed when students in either group were addressing motivation challenge: in response to the motivation challenge, about, 3.7 percent of members of the high MH group retried a maladaptive path once more on average while about 18 percent of members of the low MH group tried such a maladaptive path 1.5 times more on average. The most frequent maladaptive path retried for both groups was Motivation➞Passive➞Did Not meet one's goal.

Table 5

Frequencies of repetitive maladaptive paths for both groups

	Low MH Group					High MH Group		
	Motivation *Goal management	Motivation *Persist	Motivation *Passive	Mental health* passive	Sum	Motivation *Passive	Goal and Planning*goal management	Sum
Number of repetitive maladaptive paths	1	2	3	1	7	1	1	2
Number of students	1	1	3	1	5*	1	1	2**
Avg. of maladaptive paths retried	1	2	1	1	1.4	1	1	1

Note: *(22.7% of total students in the group) **(7.4% of total students in the group)

RQ3: How do students in each group interpret their mental health collected during weekly study sessions over the course of a semester?

For RQ3, we examined the SRL Report by focusing on question one about strengths and weaknesses in the four areas (i.e., academic engagement, mental health, goals, challenges) and question two where students identified a target for change. We engaged in three rounds of coding and in all rounds, coders were blinded to the group membership for any student. For the first round of coding, we indicated with a 1 for yes and a 0 for no if each student had addressed the requirement of the assignment. For example, if a student wrote about a strength of their academic engagement but not a weakness, they would receive a 1 for the strength and a 0 for the academic engagement. This type of quantitative coding allowed us to compare the contents of the SRL Report between the two groups (see Table 6).

Table 6

Descriptives from the SRL Report for both groups

	SRL Report question one						SRL Report question two			
Group	AE Strengths	AE Weaknesses	MH Strengths	MH Weaknesses	Goals Strengths	Goals Weaknesses	Target Mental health	Target Motivation	Target Academic engagement	Target Other
Low MH n=21*	15	15	13	20	17	12	9	6	4	2
High MH n=27	22	20	22	16	15	16	4	7	9	7

Note: One student in the low group only completed part 1 of the SRL Report. Other target for the low group included metacognition and planning; for the high group, planning (n=3), time management (n=2), and sleep/physical health (n=2).

In the second round of coding, causation coding was used to highlight attributions or beliefs individuals possess about how and why certain outcomes occurred (Miles et al., 2014). This analysis focused on responses to the question about why mental health was a strength or weakness based on weekly online SRL diary tool data. Causes, conditions, contexts, and/or consequences about their mental health were identified in the written responses, using guidelines outlined in Saldaña (2013). One researcher coded the strengths and weaknesses data for mental health into three potential categories: the antecedent (i.e., pre-existing or initiating conditions), mediating (i.e., causes, contexts, actions), and outcomes (i.e., consequences). A second researcher coded half the data into these three categories. Discussions held between coders help find agreement with the codes. This round of coding revealed students in both groups described their mental health as a positive outcome and a negative outcome, with some similarities and differences across both groups. The third round of coding included creating category labels codes identified within each group.

Mental Health as a Positive Outcome

The most common positive outcome for both groups was higher mental health. For example, a student in the low MH group wrote, "My strengths for mental health were that I was generally happy, interested in life, confident to express my opinions" (Participant L1). A high MH group student wrote "In terms of mental health, I have very high levels of well-being. I see this as an asset to my academics and I put a lot of effort into maintaining strong mental health for myself" (Participant H1). See Table 7 for a summary of all antecedents and mediating causes reported by both groups.

Low Group: Positive Outcome

Overall, students in the low group did not list as many strengths as they did weaknesses. Antecedents to the mediating causes for higher mental health were confidence, a romantic relationship, and metacognition (see Table 7). One student explained "I am having a relationship with a girl in my hometown. This gives me both strengths and weaknesses" (Participant L2). Additionally, one student described their use of metacognition as a pre-existing "ability to recognize and acknowledge how I'm doing as well as strategies and surroundings" (Participant L3). Mediating causes for mental health strengths included the three factors of mental health: psychological well-being (i.e., warm and trusting relationships, confident to express opinions, sense of direction/purpose), social well-being (i.e., understanding of society), and emotional well-being (i.e., generally happy, interested in life). One student reported noticing "on the rare occasions that I did socialize (such as getting together with coworkers) I also felt more uplifted" (Participant L4). Additionally, students described engaging with SRL strategies and processes such as metacognition, emotion regulation, strategy adjustment, academic engagement, exam studying, and goal

management. One student wrote “with my better days I tried to switch up my strategies if I was struggling academically” (Participant L5).

Table 7
Causation coding for mental health as a positive outcome for both groups

Group	Antecedent	Mediating Causes	Outcome
Low MH Group	• Metacognition • Psychological well-being • Social well-being	Self-regulated learning processes and strategies • Metacognition • Stress management • Adjust strategies • Academic engagement • Exam studying • Goal management Mental health • Social well-being • Psychological well-being • Emotional well-being • Stress management • Exercise • Self-care	Higher mental health
High MH Group	High mental health • High emotional well-being • High social well-being Love university • Positive adjustment to university • Independence • Being in control Traits • Stress-free disposition • Self-awareness • Good life	Physical health • Healthy • Exercise • Nutrition • Sleep Effective strategies • Mindfulness • Good stress management • Keep busy • Self-improvement Academics • Goal-setting • Engaged in research • Confidence Mental health • High social well-being • High emotional well-being • Maintain good mental health • High psychological well-being	

High Group: Positive Outcome

Students in the high group listed more strengths than weaknesses for their outcome of higher mental health (see Table 7). Antecedents to the mediating causes were high mental health, loving university, and personal traits. Several students wrote about their pre-existing personal traits, with one student writing "I am very blessed to live a happy and healthy life" (Participant H2), and another student writing "I've always had a good life and [it] never crossed my mind that it was bad" (Participant H3). Mediating causes for higher mental health included physical health, effective strategy use, academics, and the three factors of mental health: psychological well-being (i.e., sense of direction), emotional well-being (i.e., satisfied with life), and social well-being (i.e., belonging). Relationships were often listed by students in the high group, for example "I have been able to manage my mental health by working out, making friends, and having healthy relationships with others" (Participant H4). Some students were more specific about the types of social interactions they found beneficial: "I have made a close-knit group of friends from my residence and joined the men's field hockey team as an extracurricular activity and mean[s] of exercise" (Participant H5).

Mental Health as a Negative Outcome

The most common negative outcome for both groups was lower mental health. For example, a student from the low MH group wrote "I rarely felt happy throughout the second semester because I was always so stressed. This negatively impacted my mental health" (Participant L6). A student from the high MH group wrote "My main [mental health] weakness is when I become overwhelmed and stressed by course work, which happens mainly when my time management is less than satisfactory" (Participant H7). See Table 8 for a summary of all antecedents and mediating causes reported by both groups.

Low Group: Negative Outcome

The main outcome described by students in the low group was lower mental health. Students in the low group gave myriad reasons for having lower mental health during the university semester (see Table 8). Antecedents to these reasons included having a mental illness, pre-existing stress, a history of low overall mental health, low emotional well-being, or low psychological well-being. The mediating reasons for poor mental health can be loosely grouped into academics, socio-emotional, and career. The academic causes included ineffective strategy choices such as persist or passive strategies, poor time management or motivation, a heavy course load, and academic performance. One student said their low levels of well-being are "probably because of the pressure I have on myself to maintain a high GPA to keep my scholarship" (Participant L6).

Socioemotional causes for poor mental health included relationship anxiety, loneliness, not feeling happy, fluctuations in mental health, negative emotions, poor physical health, social distractions, perfectionism, task management, and low confidence. One student explained that "sometimes I lacked confidence in my work or what I was doing, which put me in a bit of a bad state" (Participant L8). Career concerns were reported by one student who explained their poor mental health "comes from my uncertainty of what I want to do with my life or who I want to become" (Participant L7). Students used the data from their MHC-SF measure on the weekly MyPlanner to identify the specific areas that were weak in their social well-being (i.e., feelings of belonging, how society works, society as a good place) and psychological well-being (i.e., I don't have something important to contribute to society, my life has no sense of direction or meaning).

Table 8

Causation coding for mental health as a negative outcome for both groups

Group	Antecedent	Mediating	Outcome
Low MH Group	• History of low mental health • Maladaptive learning pattern • Mental illness • Mental health not priority • Relationship • Stress • Low emotional well-being • Low psychological well-being	Academics • Academic stress • Use passive strategies • Use persist as a strategy • Heavy course load • Poor time management • Need high GPA for scholarship • Low motivation Socioemotional • Don't feel happy • Fluctuations in mental health • Negative emotions • Poor health • Relationship anxiety • Lonely • Low confidence • Low psychological well-being • Low social well-being • Perfectionist • Social distractions Career • Uncertainty for future career	Lower mental health
High MH Group	• Inaccurate score • Heavy course load • Ineffective time management	• Fluctuations in mental health • Low social well-being • Lack of interest • Low emotional well-being • Many deadlines	

High Group: Negative Outcome

The high group showed more variability in their outcomes, with seven outcomes, including: lower mental health, exercise, academic performance, repetitiveness, low emotional well-being, low social well-being, and low psychological well-being. However,

like the low group, lower mental health was the most dominant outcome (see Table 8). Antecedents reported were heavy course load, and ineffective time management, and inaccurate MHC-SF score. One student wrote "I received a [mean] score of 60.2, indicating a high level of well-being yet I constantly find myself feeling stressed, anxious, and occasionally, depressed (Participant H6). Mediating causes were low social well-being (i.e., not belonging), low emotional well-being (i.e., not happy), lack of interest, many deadlines, and fluctuations in mental health. One student wrote "...recently, my well-being decreased slowly throughout the semester. This is probably due to the extreme amount of assignments due within a close period of time" (Participant H2).

Discussion

The purpose of this case study was to examine mental health and adaptive regulation exhibited by two contrasting groups of students (i.e., the high mental health group and the low mental health group) in a university learning-to-learn course. Students' responses to a weekly online SRL diary tool and an end-of-semester writing assignment (i.e., the SRL Report) were examined using descriptive statistics and causation coding. The findings from these analyses can be summarized in two themes: (a) students with higher mental health showed more adaptive regulation of learning, and (b) metacognitive awareness around mental health may foster student success.

Adaptive Regulation of Learning and Mental Health

Several findings support that students in the high group evidenced more adaptive regulatory strategies and processes during learning. First, students in the high group reported attaining 87% of their self-set goals compared to students in the low group who reported attaining 74% of their goals. By operationalizing student success as attaining self-set goals

(Davis & Hadwin, 2019), we can conclude that students in this study with higher mental health were more successful than students with lower mental health. Davis et al. (2019), found that psychological well-being and goal attainment were not associated over time. These findings were replicated by Rostampour et al. (2020) using Keyes' (2009) mental health measure. Thus, there may be a mediation or moderation effect occurring between mental health and goal attainment that future research should examine.

Second, students in the low MH group tried more maladaptive regulatory paths than students in the high MH group. Maladaptive regulatory paths were defined as instances when a challenge--strategy--goal attainment path was unsuccessful and subsequently repeated. On average, 23% of members of the low MH group tried a maladaptive path once more, whereas 7% of members of the high MH group tried a maladaptive path once more. This finding indicates students in the low MH group may not be engaging in metacognitive monitoring of their goal progress to a lesser degree in order to make adaptations. For motivation, the most frequent challenge for both groups, 4% of the high group tried a maladaptive path once more compared to 18% of the low group who tried a maladaptive path 1.5 times more than once. These findings indicate students from the high MH group were less likely to engage in maladaptive regulatory patterns compared to students in the low MH group, particularly with motivation challenges. However, both groups consistently struggled with motivation challenges throughout the semester, and students were consistently using strategies with low rates of goal attainment (e.g., persist, passive). Targeting motivation remains an important part of teaching SRL to students at university; by considering the role mental health may play in motivation would be a salient topic for motivation and education researchers.

Metacognitive Awareness and Mental Health

Students' metacognition around their learning was evidenced by (a) both groups' beliefs about mental health, and (b) the process of completing the metacognitive intervention of the SRL Report. Students in both groups held inaccurate beliefs about mental health that may affect their metacognitive awareness around their mental health during learning. One indicator of inaccurate beliefs could be that students in the high MH group were always successful in attaining their goals when they reported a mental health challenge. Conversely, students in the low MH group were unsuccessful in attaining their goal 75% of the time, mostly because three out of the four times they experienced a mental health challenge, they used a passive strategy (i.e., did nothing or avoid the task). These different responses may be due to the beliefs students in both groups have about mental health. Students in the low group in the SRL report described the presence of a mental illness as an antecedent to their lower mental health. This belief could be a reason why students did not use a more effective strategy if they felt a challenge to their mental health was out of their control. Keyes' (2005) dual-continua model establishes mental illness and mental health are separate, yet related constructs, and that 100% of the population has mental health, regardless of whether they have a mental illness. Thus, beliefs students hold about mental health and mental illness may not be as nuanced.

Further, students in the high MH group reported believing their good mental health was a trait or a disposition. This may suggest these students have a type of “fixed mindset" (e.g., Dweck, 2006) view in that mental health is something individuals either have or do not have. Or this could be similar to the stability bias in memory as identified by Kornell and Bjork (2009). Students with stability bias believe they will always remember learned

information, underestimating the power of forgetting and the fallibility of human memory. Students in the high MH group may believe their mental health will always be high and stable. One benefit of this belief is these students were able to effectively address all mental health challenges due to their belief that their mental health is a stable trait. However, just because their mental health was stable during this one semester does not mean their mental health will not change in the future. Mental health is subject to fluctuations over time (Keyes, 2002, 2003), therefore students in the high MH group could be more at risk if they have not realized through metacognitive monitoring and control that their high mental health during learning is due to their adaptive regulatory responses. Thus, as both groups of students held faulty beliefs about mental health, mental health literacy must be a part of any research with university students to ensure they are receiving accurate information about their mental health so they can take strategic action in the face of challenges.

Students in both groups also evidenced different types of metacognitive awareness on the SRL Report. In this course, students were engaging in two levels of metacognitive interventions: the micro-level metacognitive intervention of the weekly online SRL diary tools, and the macro-level metacognition intervention of the SRL Report. This was an advantage of this study design: students learning-to-learn are ideal participants in examining SRL processes as they will use a broader range of strategies and tactics than other students (Winne, 2014). Students in the high MH group had higher social well-being and reported social relationships (i.e., social well-being) as instrumental to their higher mental health. With their mental health challenges, these students used help-seeking (i.e., worked with a friend or asked for help) whereas the students in the low MH group never used help-seeking

as a strategy. Students in the high MH group recognized their social relationships were helpful in attaining their goals and for their mental health.

For students in the low MH group, the SRL Report was a critical intervention for around half of the students. After analyzing their strengths and weaknesses in their mental health, nine out of the 22 students identified their poor mental health should be a target for change. Further, students in the low MH group were able to identify SRL processes and strategies as helpful for better mental health, whereas only a few students in the high MH group did. This reveals that the SRL, as a metacognitive intervention, is helpful for guiding students through the process of collecting and analyzing their own learning data. Students need tools and methods (e.g., the SRL Report) to keep track of their data, recognize patterns in their behaviour, and make changes (see Winne, 2005). Importantly, by engaging in metacognitive awareness of their own learning data and specifically their mental health from the online SRL diary tool, students were able to recognize their overall mental health during the semester was poor and needed attention. Finally, students in the high MH group described goal-setting as a cause for their higher mental health, but their more common reasons focused on physical health, self-care strategies, and social well-being. Future research should examine how metacognitive interventions can be used with students to collect data about their learning and mental health to increase student success at university.

Limitations

Like any study, the findings from this study are not without cautions. First, an extreme case study design was employed with the aim of examining complex SRL process and strategy use among two groups of students expect to act similarly as they are both enrolled in a course to learn about SRL, and how to apply it to their learning. Using a

combination of between- and within-person descriptives, identified a group of students whose mental health was consistently high and a group of students whose mental health was consistently low. Even though differences between the two groups were identified, there are several disadvantages of a case study, one of which is the limited generalizability of these findings due to the small sample sizes. Also, mental health is ubiquitous as students in both groups experienced mental health challenges and other challenges (i.e., motivation and goal/planning) at the same rates. Additionally, fluctuations over time in mental health are normal and the way the two groups were identified did not address these fluctuations. Therefore, future researchers should exercise caution and forethought about how to examine the complex interplay between mental health and learning, especially regarding over time fluctuations.

This study was conducted with students during course-based learning activities, as opposed to participants in a study on learning conducted in a lab setting. Although collecting students' interpretations and perceptions of their learning is vital, we only captured students' perceptions and interpretations in this study through self-report, subjective data. However, findings from this study have potential to guide future researchers interested in further examining mental health and SRL by providing particular areas of interest, for example goal attainment, challenges, adaptive regulation, and metacognition. Also, in the online SRL diary tool, there was a goal-setting intervention. This intervention guided students' creation of their self-set goal in week 4 of the Fall 2018 semester and in weeks 4 and 5 of the Spring 2019 semester. For the rest of the weeks, the structure of the online SRL diary tool remained the same. However, it is possible changes in goal attainment could have been affected by this intervention, even though our analyses did not determine there were any quantitative

differences. Next, for our figures about frequency and prevalence of strategies, any negative associations between popularity and effectiveness of a strategy may not be reliable because our evaluation of such underused strategies is based on limited number of observations.

Finally, 39% of students in the high group reported always attaining their goals compared to 23% of students in the low group. Students who report always attaining their goals may be setting low quality goals, too easy of goals, or reporting they attained them if students perceive that is what the instructor wants to see. We did not categorize goals due to quality, therefore we cannot be sure the reasons behind these students always attaining their goals. But, as we were interested in students' attainment of self-set goals, the students in the higher mental health group were more successful overall than the lower group students and future research may want to examine these students in more detail.

Conclusions and Implications

A growing concern on university campuses around the world is students' mental health. Mental health promotion and literacy programs are becoming more common, however few studies have specifically examined how mental health is implicated during learning. This study contributes to the field by examining the interplay of mental health during learning with students in a learning-to-learn course. Understanding students' engagement in adaptive regulatory processes and their evaluations of their mental health during learning has the potential for improving student success at university.

Theory

SRL is a mediator between-personal characteristics, for example mental health, and academic success (Pintrich, 2004). Theories of SRL already include myriad facets of learning: behaviour, cognition, motivation, and emotion. The findings from this study

support the importance of considering mental health during self-regulated learning. From this study, we can add that mental health is not only a condition, but also a product that may affect engagement with any of the 4 phases of the Winne and Hadwin (1998) SRL model. For example, a student's mental health may affect how their challenges and strategies are reported and chosen (i.e., condition) and may also be a product of using passive strategies avoiding the task, which may affect future attempts to SRL. Another theoretical contribution comes the comparison of the three factors of mental health between the two groups. We found in this study that students in the low MH group had higher psychological well-being and lower social well-being than the high MH group. Students in the low MH group may have been undermining their social well-being by boosting their psychological well-being to do well in university. However, as these students reported socioemotional challenges negatively affect their mental health, this pattern is not sustainable. Therefore, further work needs to be conducted to establish theories that integrate how the factors of mental health interact with students' use of SRL processes and strategies.

Research

This study provides several contributions on the role of mental health in adaptive regulation of learning as well as highlight further areas for investigation. Previous research has supported Keyes' theory of mental illness and mental health as separate yet related constructs (Keyes, 2003), but it remains unknown as to how students' beliefs around their mental health affect their learning at university. This could be a potential barrier to future research on mental health and thus including mental health literacy to students is essential to ensure they have accurate, up-to-date knowledge. Additionally, using an extreme sampling approach provided valuable differences between students with different mental health and

how they engage with SRL. Using qualitative causation coding of students' responses to a course-based metacognitive intervention provided opportunities to see how students perceive their strengths and weaknesses. Finally, including mental health in research on and during learning may provide benefits for students to recognize how their mental health affects their learning.

Practice

Findings from this study suggests two metacognitive interventions (i.e., weekly online SRL diary tool, SRL Report) guiding students through collecting, analyzing, and taking action around their learning data are useful when they include questions about mental health. Students with lower mental health may particularly benefit from these interventions, but students with all levels of mental health may benefit from reflecting on their mental health strengths and weaknesses and how what they are choosing to do benefits or hinders their learning approaches. Social well-being may be useful in fostering learning at university. Mental health literacy programs could highlight social well-being but should include accurate information about mental health using Keyes' (2005) model that includes all three factors of well-being. Broadening the scope of mental health promotion programs on university campuses to include interventions students can use to better understand themselves as learners will not only improve their mental health but also help foster their success.

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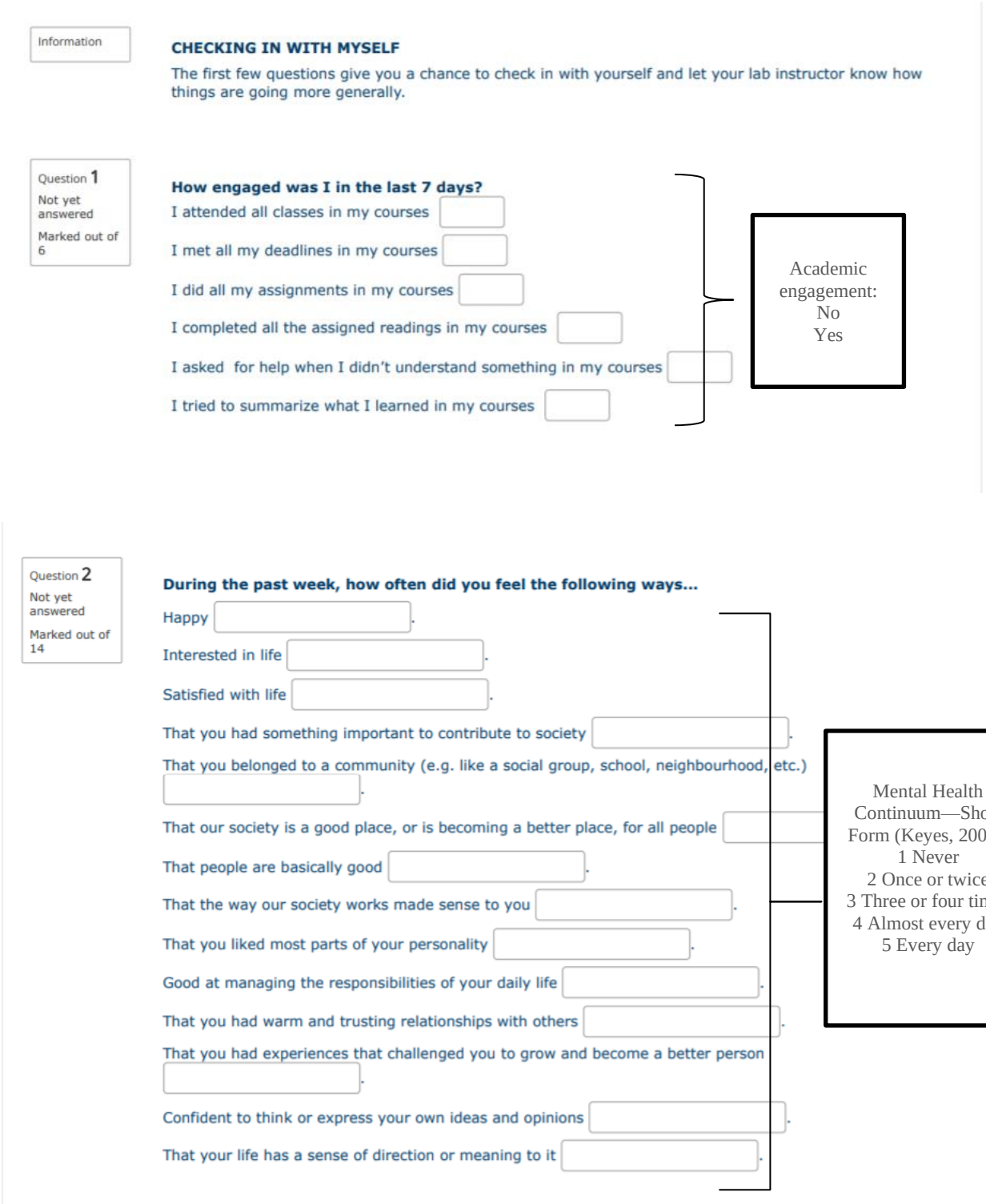
Appendix A: Online SRL diary tool questions (Hadwin et al., 2019)



Question 3
Not yet answered
Not graded

Is anything notable going on for you academically at the moment? Feel free to share any struggles, worries, or special accomplishments/achievements with your lab instructor by using this space.

Challenge: Motivation, procrastination, confidence, goal & time management, choosing or using strategies, learning and remembering, life & self management, getting to class, optimizing location/conditions for study, language & communication, adjusting to a new culture, feelings/emotions, mental health & well-being, something else

Information

PART 2: PLANNING FOR THE NEXT WEEK

Question 4
Not yet answered
Marked out of 2

The most important issue for me to tackle this week is: _____ If something else: _____

Question 5
Not yet answered
Marked out of 1

Why is this important for me this week?

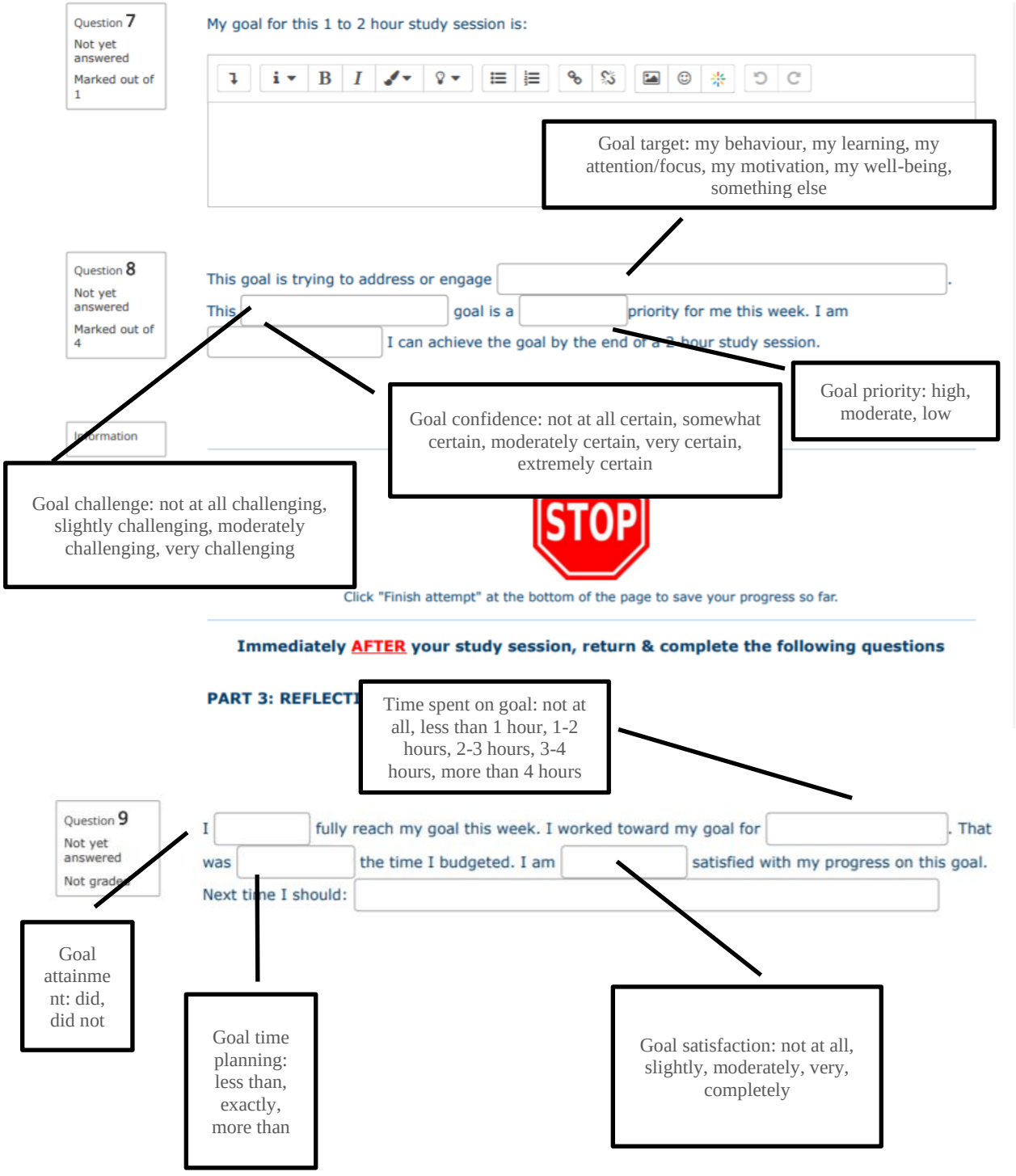
Information

Consult your calendar looking over the week to come. Choose one study session (1-2 hour block). The rest of the MyPlanner guides you to plan for that study session and [after the stop sign] reflect on it after it is completed. Since you can't change everything at once, the MyPlanner encourages you to take an SRL approach to one study session every week. If you find yourself starting to think like this for all your study blocks, you know you have become an SRL learner.

Study session activity: studying, doing an assignment, reading, lecture learning, practice questions or problems sets, writing an essay,

Question 6
Not yet answered
Marked out of 2

During my 1-2 hour study session, on _____ at _____ time, I will be working on _____ in _____ *(eg. PSY 100).*

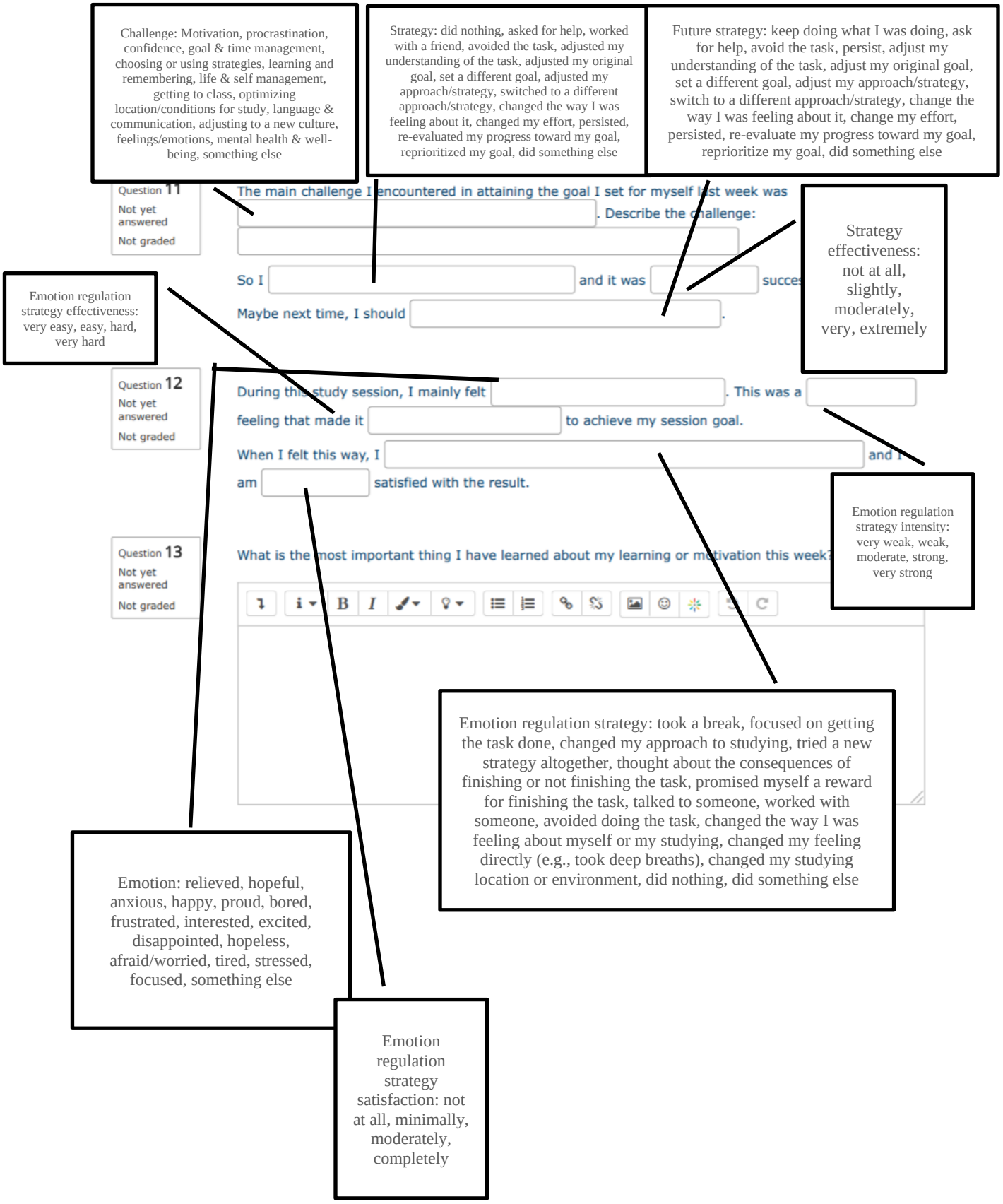

Question 7
Not yet answered
Marked out of 1
My goal for this 1 to 2 hour study session is:
Goal target: my behaviour, my learning, my attention/focus, my motivation, my well-being, something else
Question 8
Not yet answered
Marked out of 4
This goal is trying to address or engage
This goal is a priority for me this week. I am
I can achieve the goal by the end of a 2 hour study session.
Goal challenge: not at all challenging, slightly challenging, moderately challenging, very challenging
Goal confidence: not at all certain, somewhat certain, moderately certain, very certain, extremely certain
Goal priority: high, moderate, low
STOP
Click "Finish attempt" at the bottom of the page to save your progress so far.
Immediately AFTER your study session, return & complete the following questions
PART 3: REFLECTI
Time spent on goal: not at all, less than 1 hour, 1-2 hours, 2-3 hours, 3-4 hours, more than 4 hours
Question 9
Not yet answered
Not grade
I fully reach my goal this week. I worked toward my goal for . That
was the time I budgeted. I am satisfied with my progress on this goal.
Next time I should:
Goal attainment: did, did not
Goal time planning: less than, exactly, more than
Goal satisfaction: not at all, slightly, moderately, very, completely

Question 10
Not yet answered
Marked out of 11

How much of a challenge were each of these during the last week?

CHALLENGES	MY RATING	EXAMPLES
Motivation & Procrastination *The will or desire to do my work*		Difficulty persisting Difficulty getting started Low interest or will Kept putting it off
Confidence *Confidence in attaining my goal.*		Believing I could succeed Believing I could figure it out Doubting my ability Having low expectations of myself Feeling like I am bad at this
Goal & Time Management *Setting goals and managing & prioritizing time.*		Finding time to work Breaking things down into smaller goals Prioritizing time & tasks Organizing my time Running out of time Setting goals for studying Missing deadline/s
Choosing or Using Strategies *Knowing which strategies to use.*		Didn't know how to approach it Didn't know a strategy to use Chose the wrong strategy Didn't know how to fix my strategy
Learning & Remembering *Being able to remain focused on learning and remembering key information.*		Couldn't remember things Kept losing focus Couldn't figure out what was important Couldn't apply what I was learning Couldn't explain concepts/ideas
Mental Health & Well-being *How I cope with relationships, work, and stress to be productive.*		Sick/tired or not eating well Not enjoying being at university Family and relationship issues Feeling stressed and overwhelmed most days Not feeling in control of my life
Optimizing conditions/setting for study *Finding a suitable workspace.*		Finding a good workspace Too many distractions Distracted by friends/roommates Not conducive for thinking/learning
Language & Communication *Being able to communicate ideas.*		Didn't understand words Couldn't express ideas Stuck on terminology Didn't know how to ask a question Couldn't think about it in English
Adjusting to a New Culture *Adjusting to new learning situations and contexts; making new friends*		Feeling lonely Missing friends/family Unsure of what is expected of me Unsure of what is appropriate Overwhelmed by how different things are
Emotions *The role emotions played in your work this week.*		Anxiety, boredom, excitement, worry, anger, frustration, sadness, hopelessness, guilt, shame, disappointment, etc.

Challenge rating:
0-Not applicable this week
1
2
3
4
5-Negatively affected me this week


Challenge: Motivation, procrastination, confidence, goal & time management, choosing or using strategies, learning and remembering, life & self management, getting to class, optimizing location/conditions for study, language & communication, adjusting to a new culture, feelings/emotions, mental health & well-being, something else
Strategy: did nothing, asked for help, worked with a friend, avoided the task, adjusted my understanding of the task, adjusted my original goal, set a different goal, adjusted my approach/strategy, switched to a different approach/strategy, changed the way I was feeling about it, changed my effort, persisted, re-evaluated my progress toward my goal, reprioritized my goal, did something else
Future strategy: keep doing what I was doing, ask for help, avoid the task, persist, adjust my understanding of the task, adjust my original goal, set a different goal, adjust my approach/strategy, switch to a different approach/strategy, change the way I was feeling about it, change my effort, persisted, re-evaluate my progress toward my goal, reprioritize my goal, did something else
Question 11
Not yet answered
Not graded
The main challenge I encountered in attaining the goal I set for myself last week was
. Describe the challenge:
So I
and it was
succes
Maybe next time, I should
.
Strategy effectiveness: not at all, slightly, moderately, very, extremely
Emotion regulation strategy effectiveness: very easy, easy, hard, very hard
Question 12
Not yet answered
Not graded
During this study session, I mainly felt
. This was a
feeling that made it
to achieve my session goal.
When I felt this way, I
and I
am
satisfied with the result.
Emotion regulation strategy intensity: very weak, weak, moderate, strong, very strong
Question 13
Not yet answered
Not graded
What is the most important thing I have learned about my learning or motivation this week?
Emotion regulation strategy: took a break, focused on getting the task done, changed my approach to studying, tried a new strategy altogether, thought about the consequences of finishing or not finishing the task, promised myself a reward for finishing the task, talked to someone, worked with someone, avoided doing the task, changed the way I was feeling about myself or my studying, changed my feeling directly (e.g., took deep breaths), changed my studying location or environment, did nothing, did something else
Emotion: relieved, hopeful, anxious, happy, proud, bored, frustrated, interested, excited, disappointed, hopeless, afraid/worried, tired, stressed, focused, something else
Emotion regulation strategy satisfaction: not at all, minimally, moderately, completely